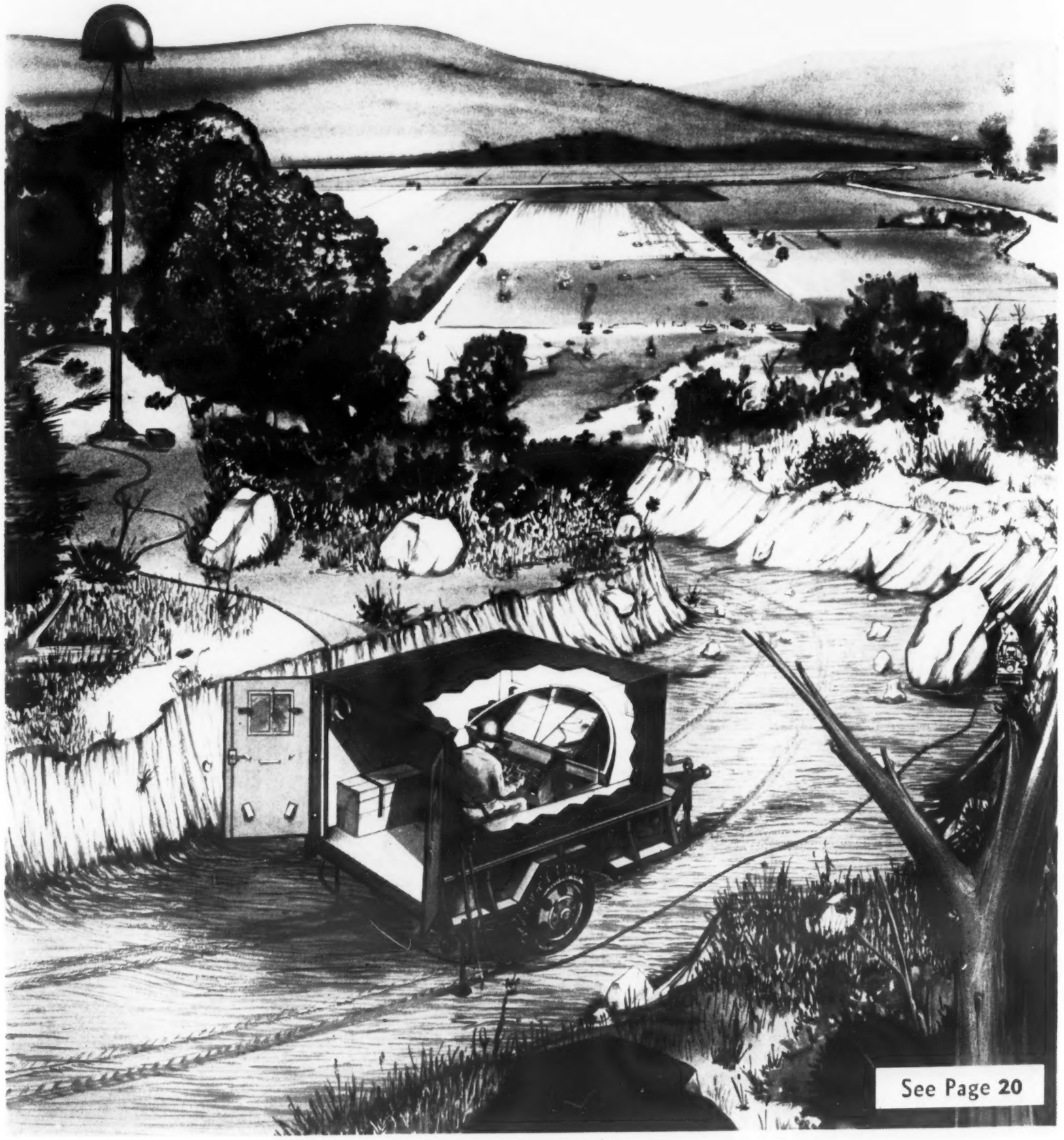
November 1959

SIGNAL

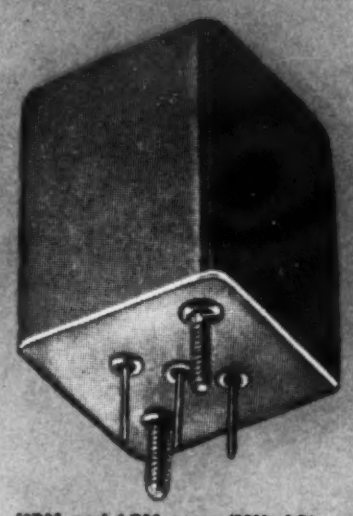


See Page 20

NEW

MINIATURIZED UNITS FROM STOCK...

UTC has led the high Q coil and filter fields for over 25 years. Fresh examples of this leadership are represented in the UTC Minifilters and Miniductors described below. Though greatly miniaturized, the designs are conservative and will provide the exceptional reliability associated with all UTC products.



HPM and LPM case (MIL AG)
1 x 1 x 1⅜"
Weight .....2¼ oz.

BPM case (MIL AF)
¾ x ¾ x 1⅛".
Weight .....1 oz.

UTC MINIFILTERS

Hermetically sealed to MIL-T-27A and MIL-F-18327 Specs.

UTC stock interstage filters have been an industry standard for over a decade. The new UTC miniature filters provide almost the same characteristics in an extremely miniaturized package. Attenuation of these minifilters is only slightly less than their larger counterparts, as is operating level. Special minifilters can be supplied for any frequency above the minimum shown for each group. Straight pin terminals are provided for printed or standard circuits.

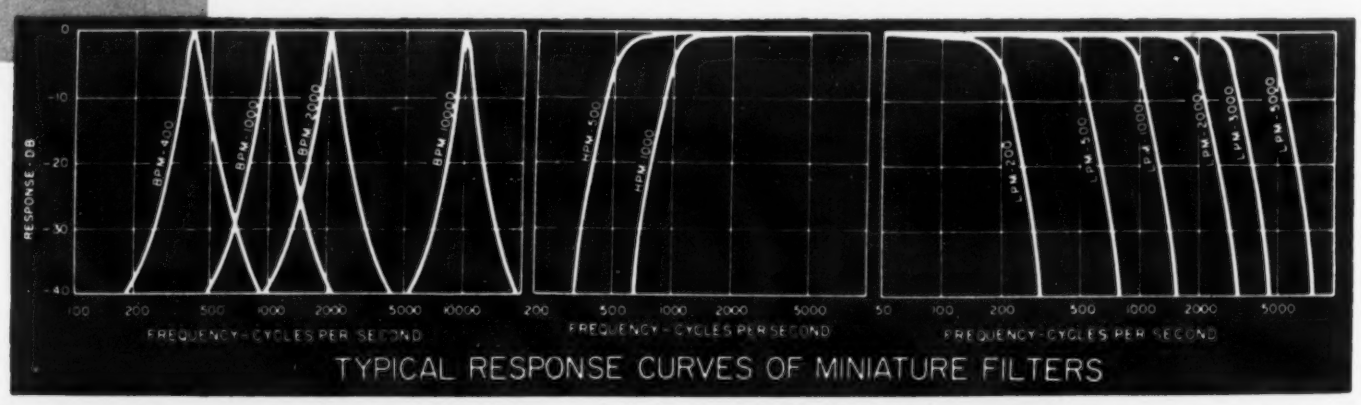
BPM units (band pass) have 2:1 gain. Attenuation is approximately 2 db ± 3% from center frequency, and 35 db per octave as shown. Input 10,000 ohms, output to grid, tapped for 10,000 ohms output to provide flexibility in transistor circuits.

HPM units (high pass) have a loss of less than 6 db at cutoff frequency, and an attenuation of 30 db at .67 cutoff frequency. Input and output 10,000 ohms.

LPM units (low pass) have a loss of less than 6 db at cutoff frequency, and an attenuation of 30 db at 1.5 cutoff frequency. Input and output 10,000 ohms.

STANDARD FILTERS STOCK FREQUENCIES

BPM—400	LPM—200
BPM—1000	LPM—500
BPM—2000	LPM—1000
BPM—10000	LPM—2000
HPM—500	LPM—3000
HPM—1000	LPM—5000

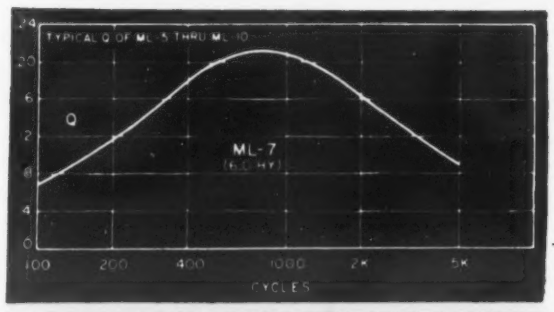


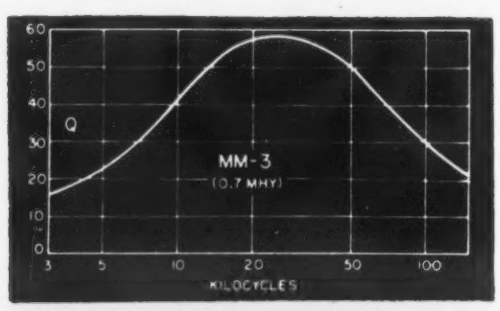
TYPICAL RESPONSE CURVES OF MINIATURE FILTERS

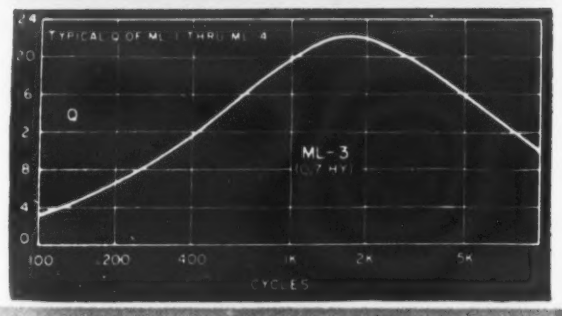
UTC MINIDUCTORS

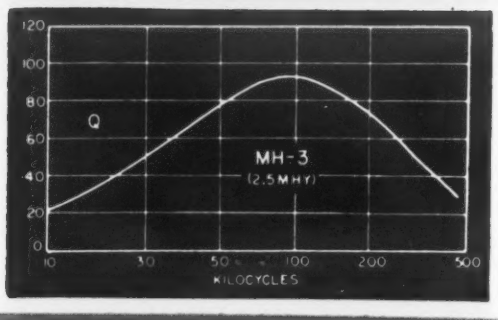
Hermetically sealed to MIL-T-27A Specs., MIL type TF5RX20YY

UTC Miniductors are ideal for transistor and printed circuit applications, providing high Q in miniature form. The ML-1 to 4 units are for medium low frequencies, adjusted to ± 3% at 1 V. 1 KC. The ML-5 thru 10 series are for lower frequencies, adjusted to ± 3% at 1 V. 400 cycles. The MM and MH units are for medium and high frequencies, adjusted to a tolerance of ± 2%. Temperature stability is excellent on all Miniductors, ± 1% from —55° C. to + 100° C. The ML group are in a Hipermalloy shield case . . . The MM and MH coils are symmetrical toroids . . . for high coupling attenuation and low hum pickup. The DCMA MAX. shown is for approximately 5% drop in inductance.

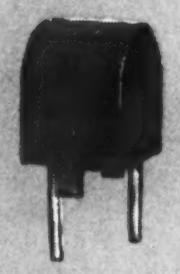








Type No.	Inductance (0 DC)		DC MA Max.
ML-1	.25	Hy.	9
ML-2	.4	Hy.	7
ML-3	.7	Hy.	5
ML-4	1.4	Hy.	3
ML-5	2.5	Hy.	1
ML-6	4.0	Hy.	.7
ML-7	6.0	Hy.	.6
ML-8	10	Hy.	.5
ML-9	25	Hy.	.3
ML-10	60	Hy.	.2
MM-1	3.	Mhy.	50
MM-2	5.	Mhy.	40
MM-3	8.0	Mhy.	30
MM-4	12.5	Mhy.	25
MH-1	.6	Mhy.	75
MH-2	1.5	Mhy.	37
MH-3	2.5	Mhy.	28
MH-4	6	Mhy.	23



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MM, MH CASE
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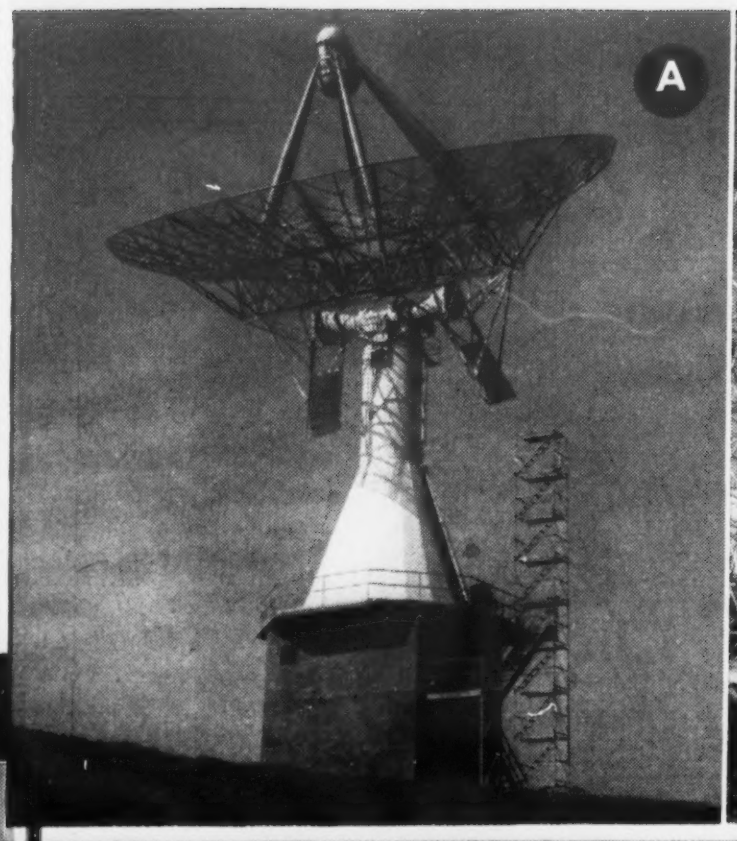

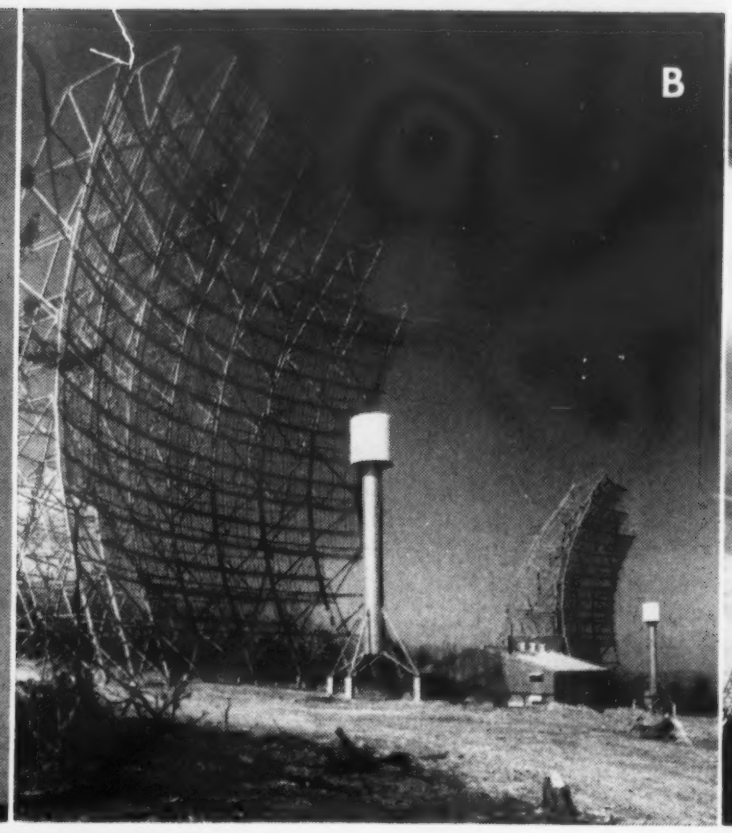

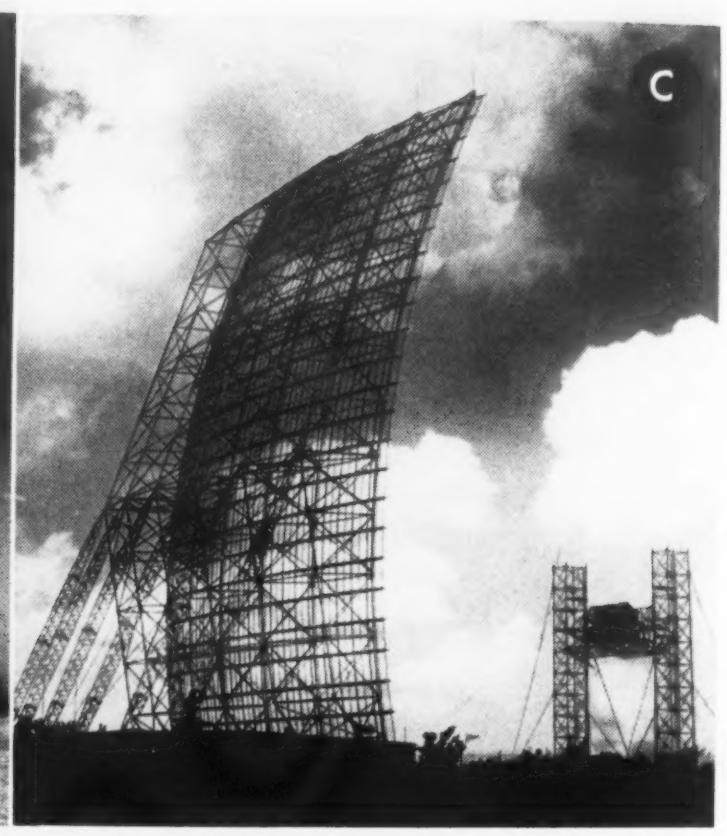

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B SCATTER ANTENNAS — *One end of a scatter link showing two 120-foot antennas. 28- and 60-foot models are also available.*

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F FIELD SERVICE — *Kennedy Field Service engineers erect an 84-foot radio telescope. Other services include site selection, constructon, personnel training and servicing.*

G RESEARCH AND DEVELOPMENT — *Kennedy's antenna service includes basic R & D in microwave propagation.*

THE solution to antenna problems begins when someone says: "Let's ask Kennedy!"

A few of the many reasons why are shown on this page. These Kennedy antennas are setting new standards for all-weather reliability and versatility wherever they serve throughout the free world.

Kennedy antennas come in many shapes and many sizes. But whatever the type, and whatever the conditions under which it must serve, Kennedy can offer a design that fully measures up to specifications.

Kennedy Field Service engineers are available to install antennas anywhere in the world. It's a part of the complete, integrated service that is still another reason why more and more people in electronics are "asking Kennedy" about antenna problems.

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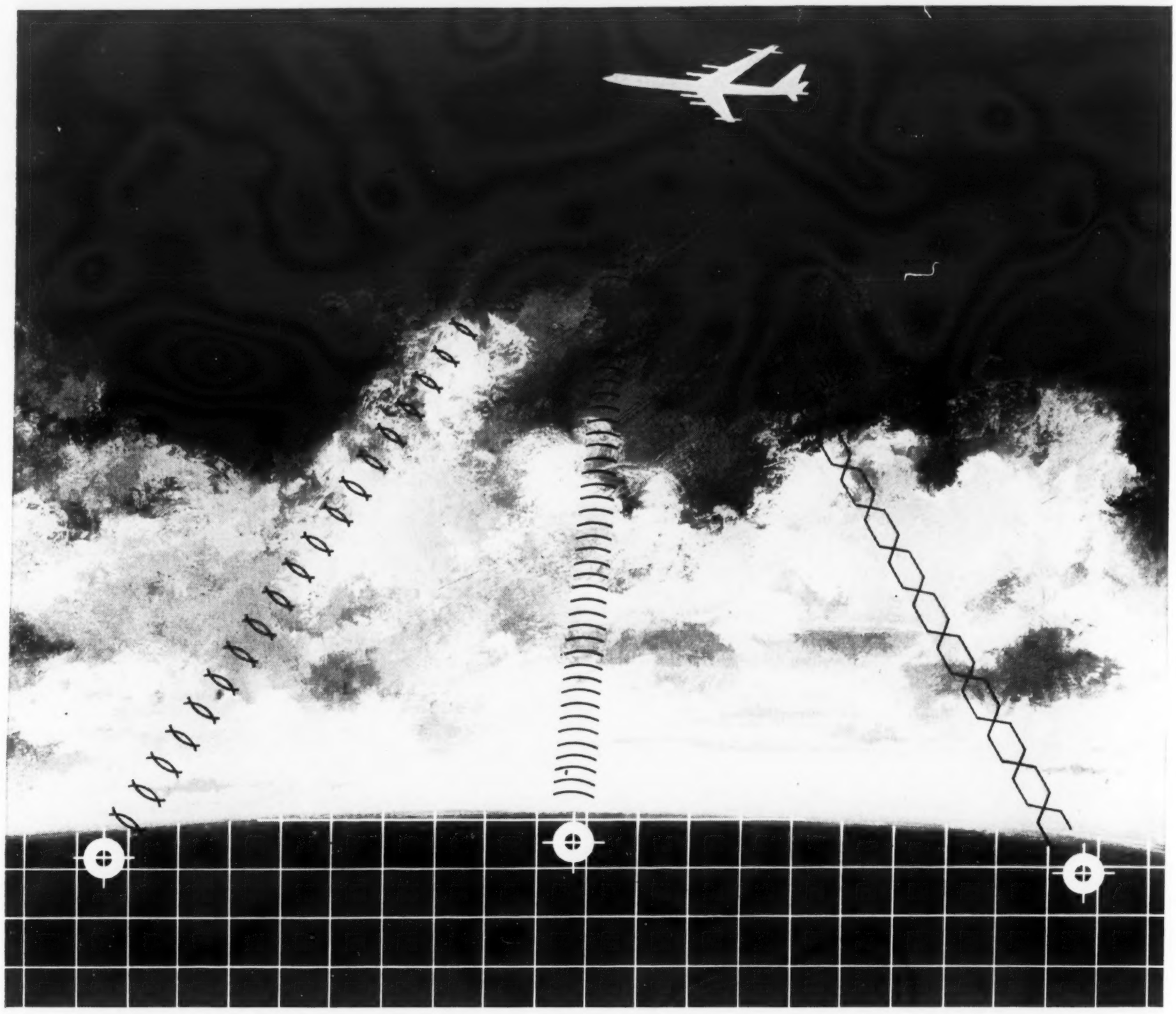

. . . advanced systems for advance intelligence

As the world's capabilities for electronic warfare expand, early warning and countermeasure systems depend more and more on advance intelligence. Electronic reconnaissance is the new watchword of the day.

Such systems, if they are to keep pace with offensive measures, demand the utmost in technical research, development and production capacities.

Sylvania has long occupied a leading position in supplying airborne and ground-based passive reconnaissance systems and subsystems to the Armed Forces. A very large part of Sylvania's research and development program is engaged in this work.

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BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XIV NOVEMBER 1959 NUMBER 3

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Cover

Capable of detecting the slightest enemy ground movement, a new ultra-sensitive frontline radar has been developed jointly by the U. S. Army Signal Research and Development Laboratory at Fort Monmouth, N. J., and the Hazeltine Corporation of Little Neck, N. Y., under direction of the U. S. Army Combat Surveillance Agency. The radar has a portable shelter containing the controls and displays, as shown in the center of the photo, and a separate antenna mounted inside a five-foot plastic bubble on a 25-foot pole, which is pictured to the left of the shelter. *Story on page 20.*

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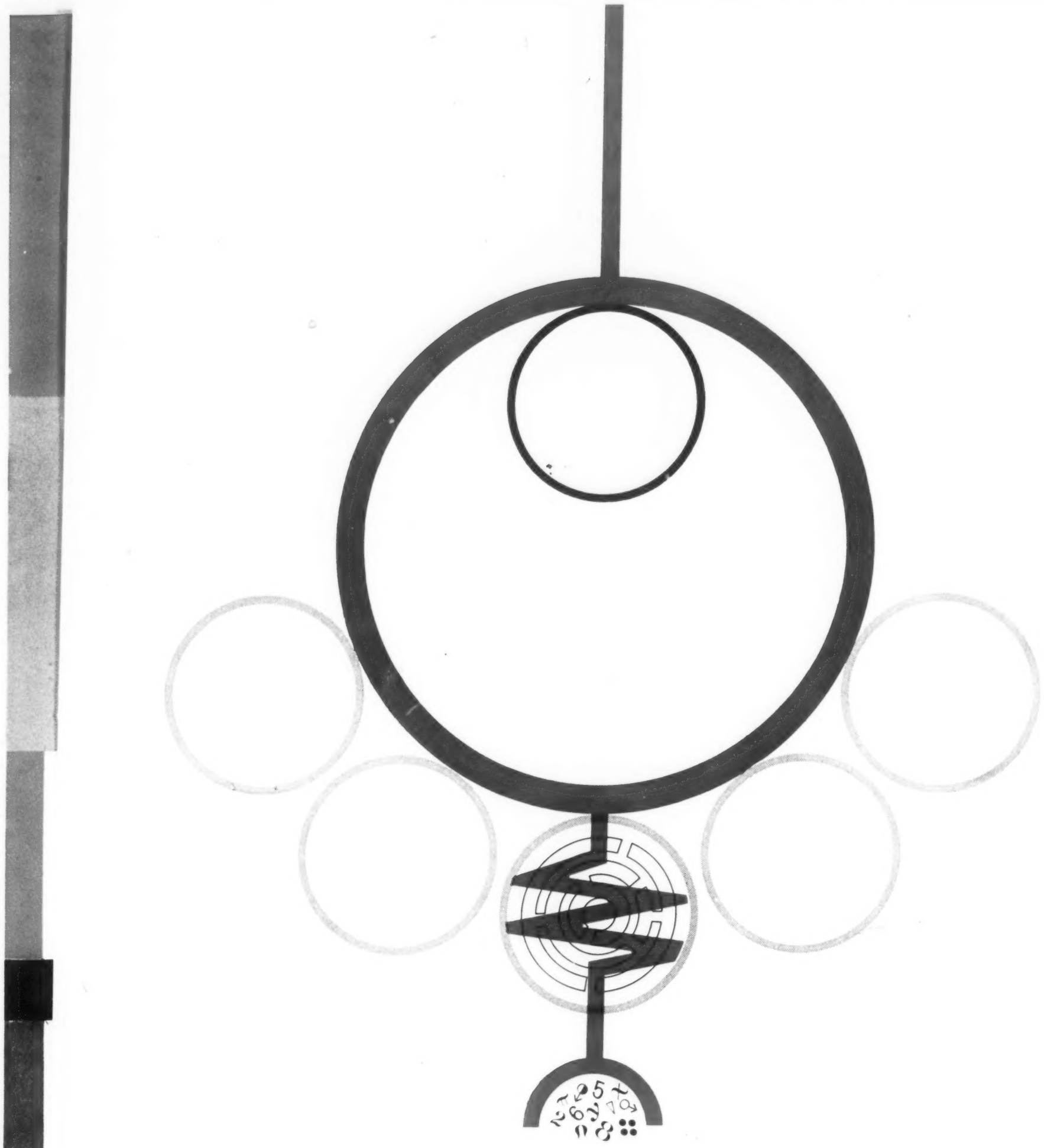

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Dear Member:
I am sure you will agree with me that we have much in common, especially when it comes to a selection of a Christmas gift for a friend. Because of our daily activities and other bona fide reasons, we invariably delay our shopping until a few days before Christmas. Then the question arises: Have we remembered everyone we should remember and/or have we selected an appropriate gift? As far as the immediate family is concerned this presents no problem. However, that important business contact, that friend in industry or military service, that outstanding employee in your plant and that "Ham" operator, engineer, student or that communications-electronics and photography enthusiast, to name a few, may very well have slipped your mind. Maybe you will remember everyone but the odds are that you may forget someone during those few hectic days before Christmas.
Last year I gave five friends SIGNAL magazine as a gift. I know the recipients were delightfully pleased. They told me the gift meant more to them than a carton of cigarettes, a box of cigars, ties, socks, etc., which all of them needed like a hole in the head.
This year let us help you by suggesting that you give SIGNAL magazine as a Christmas gift. In doing so you will perform a double service—a meaningful gift to a friend—a service to AFCEA by increasing the circulation of your Association's journal. How about it? We will enclose your personnal card or one of our own if you desire. May I suggest that you act now for this special offer is good only during November and December.

W. J. Baird, General Manager & Editor

★ ★ ★ ★

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THIS GIFT IS TO BE MADE TO A NON-MEMBER. BECAUSE OF THE SPECIAL PRICE OFFER, THE $1.00 CHAPTER REBATE WILL NOT APPLY FOR THE CURRENT YEAR ONLY.

Telephone team-up for missilemen . . .

AE CAN DO

Set up a huddle of key figures at a missile base in a matter of seconds? It *has* been done—with sophisticated switching by AE.

The new Automatic Electric 3500-line exchange at Vandenberg Air Force Base makes it possible. Conference circuits can be set up automatically on any internal, incoming or outgoing calls, and a number of men can be placed on the line as the situation demands, with a complete recording being made of the conversation.

Engineers at AE are old hands at switching techniques such as this. That's why AE is well-equipped to solve problems in automatic control for the armed services – and see the job through.

If you have a project in communications or control, AE can assist in the design, and supply the components or complete control packages. For quick results, write the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Ill.

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GENERAL TELEPHONE & ELECTRONICS

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holstering our defense with push buttons

by DR. HERBERT YORK
Director of Defense Research and Engineering
Department of Defense

(*The following was an exclusive article to* The San Francisco Examiner.)

THERE HAS BEEN an almost unbelievable advance in the military importance of electronics.

Twenty-five years ago its military application of electron-tube devices was limited mainly to radio communications. Today, electronics controls the effectiveness of every offensive and defensive weapon that our Armed Forces use.

The magnitude of this growth was indicated in a survey made recently by the Electronics Industries Association which showed that the total cost of military electronics research, development and production purchased from industry in 1957 was $3,600,000,000, slightly over 50 per cent of the entire output of the electronics industry. The 1957 bill is 36 times the total expenditure for military electronics in 1941, and it is almost one-half the estimated total cost of $7,500,000,000 for producing military electronics devices during the entire World War II period.

Reviewing the technical history of military electronics reveals that this rapid expansion was not so much the result of single technological breakthroughs as it was the systematic application of a great many advances in electronic components, circuit techniques and engineering methods.

In selecting some of the individual developments that exerted the greatest influence on the advance of military electronics, one would certainly include the magnetron, the shock resistant subminiature tube, semiconductor devices, subminiature equipment construction, the fundamental logic of the digital computer, the discovery of tropospheric and ionospheric propagation and the demonstration of echo-ranging principles.

One would easily predict some pretty fantastic military uses of electronics in the next 25 years—radio relay stations on the moon, or even on some of the planets; computers that "think" rather than merely follow programmed instructions; enormously complex electronic data processing systems packaged in the volume of a shoe box; and even wars fought in outer space by remote control from the earth. But perhaps I should confine my expectations to the immediate future and to things I can predict with more assurance.

Electronics will continue to be vitally important in military operations, and its uses will spread even more widely as new solid-state components, much smaller and more reliable, make it possible to accomplish more difficult and intricate functions. As long as world tensions persist, defense expenditures for research and development in electronics can be expected to continue increasing at a modest rate.

On the technical side, I expect that radical advances in electronics during the next 25 years will influence our military weapons and concepts of warfare to a still greater extent than before.

It is not unreasonable to believe that microwave generators with average power outputs of several megawatts will be built within five years. This kind of R-F power, at wavelengths short enough to be focused into a narrow beam with antennas of reasonable size, offers the very attractive possibility that substantial amounts of power can be transmitted from point to point without using metallic transmission lines.

Some technical experts seriously predict that within five years the application of microcircuitry technology —"molecular electronics," as some prefer to call it—will permit packaging in a 3-inch cube an entire computer having the capacity of a million words and with no detachable components.

Computers of many types will find new uses in military operations. Coupled with new world-wide, high-speed communications circuits, computers yet to be developed will analyze massive amounts of technical data under several different action conditions in a matter of microseconds. With this kind of background, a commander will be able to determine the optimum force of action under any known circumstances.

Many authorities believe that the future of communications is closely linked with outer space. We will open new channels that will again expand our communications band width. The civilian applications of these gains will be as significant as the military.

COMMUNICATIONS RESEARCH AIDS ARMY'S FUTURE PROGRESS

SMITH-CORONA MARCHANT has played a part in the development of military communications from the early days of World War II. During the war we production-engineered and produced in large quantities a device for encipherment and decipherment of military messages. Kleinschmidt, a Division of Smith-Corona Marchant since 1956, pioneered at the same time in the development of the first high-speed (100 word per minute) integrated line of military teletypewriter equipment including printers, typing reperforators and paper tape sensing and transmitting devices. Shortly after World War II this line of equipment, specifically designed to meet existing military requirements, was standardized for procurement by the U.S. Army Signal Corps and the Air Force.

Smith-Corona Marchant has been aware of the need for higher-speed and more reliable military printed communications equipments engendered by the pentomic army concept of tactical communications and the military's more critical communications problems. Relay centers, tank company's tactical control centers, aircraft and even missiles utilize communications equipment developed and manufactured by Smith-Corona Marchant.

Our recent development of a lightweight, low-parts content typewriter for the Quartermaster Corps for use by all Services is typical. Requirements established for the typewriter included: extreme ruggedness and durability, ease of mobilization and demobilization in the field, ease of maintenance with a minimum of parts, and performance with maximum efficiency under any given set of environmental circumstances.

Several recent developments in communications in which we have played a part are indicative of the strides made in keeping this function abreast of advances made in other branches of the Armed Forces:

The Midwest Relay Center, Fort Leavenworth, Kansas, has been designed as a major teletypewriter relay station in the world-wide Army Command and Administrative Network (ACAN). The relay center building contains an automatic teletypewriter switching center (AN/FGC-30), carrier, control equipment, microwave terminals, and maintenance shops. The AN/FGC-30 is a fully-automatic switching center for routing teletypewriter messages towards destinations in accordance with Joint and Combined military procedures and contains Kleinschmidt teletypewriter equipment, specifically designed for this function, as major components. (Photo page 9)

The automatic teletypewriter station passes teleprinted messages "untouched by human hands," unless there is a procedural error or a garble occurring in the message. Such errors are automatically detected and stop the equipment at a supervisory position for manual correction. The incoming messages are electrically scanned by the equipment; the precedence and routing are recognized, the cross office and outgoing circuits are established, and the messages are on their way to the distant called station automatically in a matter of seconds. In this manner, for example, a message sent from the Pentagon to Fort Carson, Colorado, through Midwest Relay may be appearing on the teleprinter in the Fort Carson Signal Office before the end of the same message has cleared the transmitter in Washington. This system, developed in close cooperation by Kleinschmidt, Automatic Electric (a subsidiary of General Telephone) and the United States Army Signal Corps, contains automatic provisions temporarily to hold traffic to permit a high precedence message to pass through the center first.

The majority of the teletypewriter equipment utilized in the AN/FGC-30 was designed specifically for use in that system. Kleinschmidt engineers were able to incorporate many novel features heretofore unobtainable in units capable of the speed and reliability required. In addition to being compact, lightweight and requiring lower power consumption, the equipment includes a unique combination tape-reader and transmitting distributor, with only one-inch spacing between reader and transmitting sensing pins. There is also a tape puller on all reperforators which operates an alarm in case the tape is not moving in a normal manner when the reperforator is receiving traffic. This

MODEL 195 TYPING REPERFORATOR

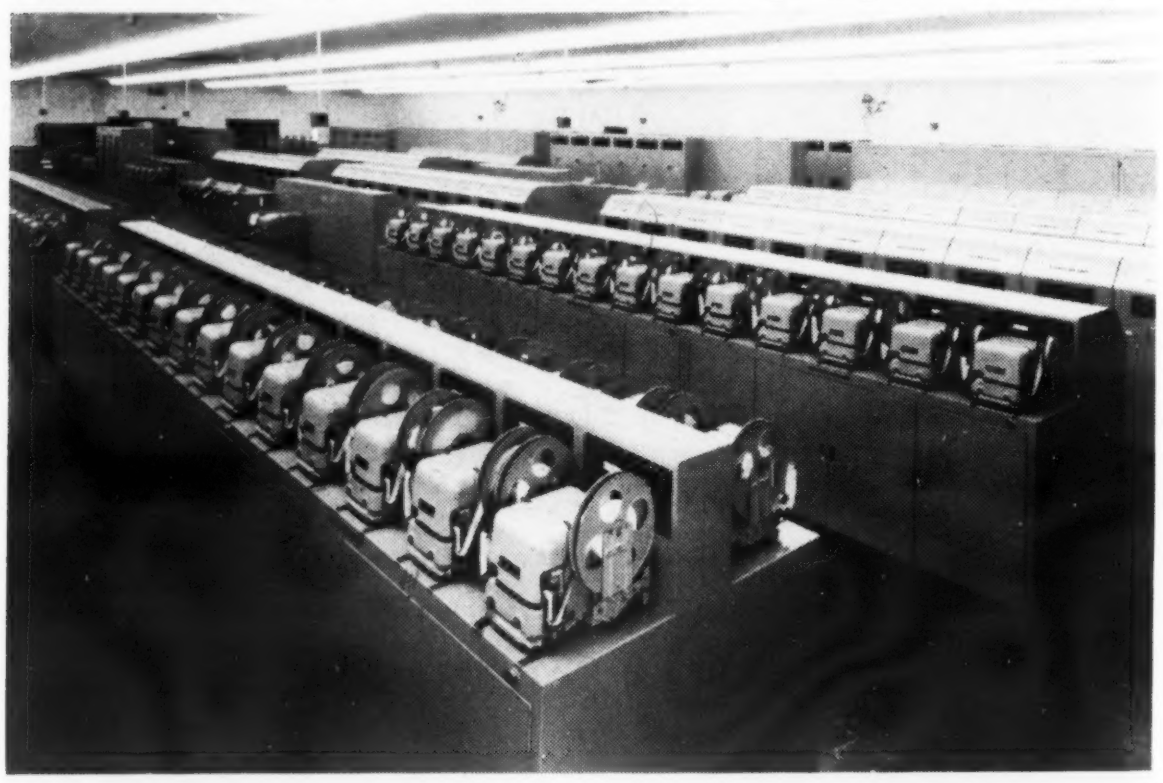
Armed Forces plans for establishment of permanent communications on a global network basis. We are also cognizant of the desirability of transmitting all information of any origin and of any nature on a common basis.

Through the efforts of our Kleinschmidt Division and of our other research and development groups we have played an increasingly important role in the communications phase of the National Defense effort. The technological know-how developed through our many years of manufacturing office equipment has been joined with the inventive capabilities of Kleinschmidt to provide invaluable solutions to many of the

alarm, in conjunction with an open-line alarm, provides maximum security against loss of message. There is also a selector magnet on the reperforator which is so sensitive that line receiving relays are not required.

The first system was installed at the Sixth Army Communication Center, Davis, California, and refinements and improvements have been added to the Fort Leavenworth and Fort Detrick installations.

The Armed Services' need for teletypewriter equipment to bridge the gap existing between conventional communications equipment and high speed, complex and cumbersome computer-type sub-systems dictated the requirements for an economical lightweight terminal device capable of operation at data rates approaching the capacity of common communications circuits. The Reperforator, Teletypewriter, designated TT-195, accomplished this. Such a device eliminates the need for multiple terminal machines and multiplexing equipment, ordinarily necessary for the full utilization of available circuit bandwidths. Communications mediums



CENTRAL OFFICE, TELETYPEWRITER AN-FGC-30, DAVIS INSTALLATION

reliable for only short periods would be usable to a greater extent with such equipment available which would be capable of high-speed "burst" transmission while retaining features compatible with telecommunications equipment in current use.

The primary requirements of the terminal device were to provide punched paper tape with printing in the conventional teletypewriter manner; five-channel Baudot code, standard type size and style, capable of accepting data and delivering this recorded information at rates and modes compatible with existing equipment, i.e., 7.0 or 7.42 unit start-stop sequential code, 60 to 100 words per minute. Reliability, minimum weight, size and power consumption, and ease of maintenance were of prime importance.

Efficient and extremely rapid mechanical energy transfer by means of a design philosophy based on elastic impact of metallic parts made possible the fulfillment of the end function required of this high speed teletypewriter.

Solid-state electronic components enabling data translations and control functions to be performed economically and reliably within minimum space and power limits proved the final key to practical equipment with performance far exceeding current standards. The Reperforator-Teletypewriter is capable of functioning at rates up to 750 words per minute.

The Type 1145 Switching System is an automatic, unattended teletypewriter switching system designed for full duplex (two-way, non-reversible) transmission. Each station in the network has a page printer as the terminal signaling and receiving unit operated on a half-duplex basis. The teleprinters and associated switching equipment are designed for operation with tone channeling equipment circuits where the receiver output is obtained from a power relay and the transmitter is keyed electronically. All switching information is originated from the keyboard of the printer and from the Line Break Switch, which is also used to start the machine. An operator wishing to transmit a message operates the Line Break Switch, turning on his printer, and signaling the central office. The signal received in the central office activates the director which assigns a link circuit to the particular call. The link circuit establishes a line between the calling station and the director-translator control circuit. By signaling with a one-character code indicating the desired station, the operator at a calling station will be connected with a link circuit to the desired station. In addition to the automatic single-call feature, the 1145 permits Group Call and Emergency All-Call operations in which the equipment alerts all unconnected stations through the director.

One of the more difficult development programs involved the designing of an Airborne Teleprinter in order to extend the military teletypewriter network to aircraft. The system uses reduced bandwidth and by production of printed copy eliminates the need of operator stand-by. Weight and size limitations and aircraft environmental problems dictated changes in standard printing mechanisms because of their bulk and eliminated the punched-tape method of storing messages since it required operator handling. Only by replacing many of the mechanisms formerly employed in teletypewriter

by EMERSON E. MEAD
Executive Vice President
Smith-Corona Marchant Inc.

design with electronic techniques was it possible to develop an operational model.

Smith-Corona Marchant, through its basic research and development groups, expects to be of further assistance to the Armed Services in the solution of problems attendant upon extension of present communication systems philosophies. We shall rely on our experience over the years in the development of printed communications, plus our current activity in the development of advanced communications and data processing equipments and techniques for the business community.

AIR LIFT

for mobile teleprinter center

Interior view of mobile teleprinter center

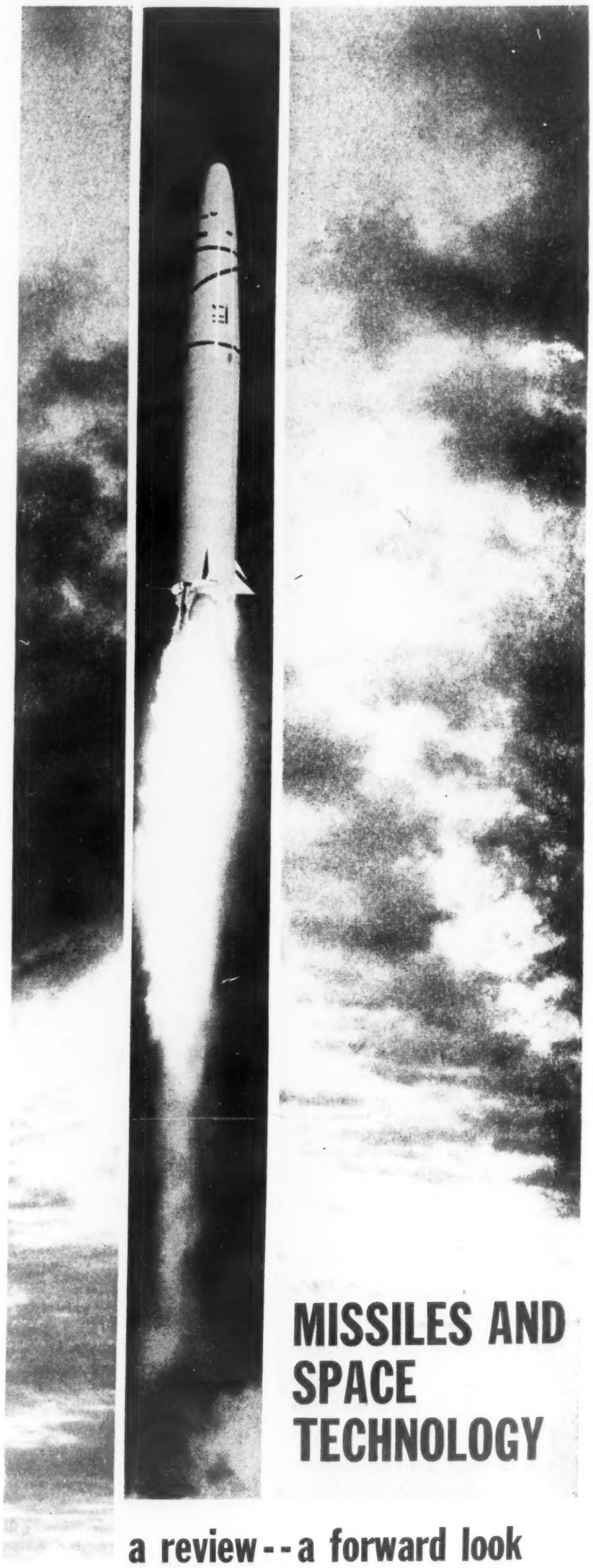
Kleinschmidt super-speed teletypewriters provide world's fastest printed combat communications for the U.S. Army!

Taking the jolts and jars of movement by air in stride, the new Kleinschmidt telecommunications units handle *printed* messages at speeds up to 750 words a minute! Using these machines, developed in cooperation with the U. S. Army Signal Corps, information on enemy movements could move accurately and rapidly to friendly units widely dispersed under nuclear battlefield conditions. In recognition of Kleinschmidt's high standards of quality, equipment produced for the U. S. Army is manufactured under the Reduced Inspection Quality Assurance Plan. Today, the advanced commercial application of electronic communications is unlimited.

KLEINSCHMIDT

DIVISION OF SMITH-CORONA MARCHANT INC., DEERFIELD, ILLINOIS

Pioneer in teleprinted communications systems and equipment since 1911



MISSILES AND SPACE TECHNOLOGY

a review--a forward look

by DR. T. KEITH GLENNAN
Administrator
National Aeronautics and
Space Administration

THERE SEEMS to be a contest going on in this country in which substantial numbers of people are attempting to outdo each other in predicting exotic accomplishments in space in the next few years. In my opinion, there is need for more common sense and good technical judgment to be injected into this picture. My position as Administrator of National Aeronautics and Space Administration (NASA) compels me to state my convictions in these matters as part of my responsibility of keeping the Congress and the public fully and currently informed.

Building on the foundation of organization, personnel, plant assets, programs and problems transferred from the National Advisory Committee for Aeronautics (NACA), Advanced Research Projects Agency (ARPA), and the military services, NASA was a going concern from the day we announced that we were in business, the first of October 1958. We lacked, as did all of the others engaged in the space business, a full realization of the complexity of the technological problems facing us. We were neophytes—and probably still are—in our understanding of the costs to be incurred in a hard-hitting, broadly-based national space program. But we had—and we still have—enthusiasm and real zeal for the great adventure that still lies before us: the discovery of new knowledge about our universe and the application of that new knowledge and supporting technology for the benefit of mankind everywhere.

Now, what have we learned from our successes and failures of the past year? And what are we planning for the future as a result of our experiences—both good and bad? Remember, please, that I am speaking about the civilian space program—not the military program.

In the first place, we have learned that we are not nearly as far advanced in space technology as we had thought or hoped. Our experiences in the space vehicle field have been less than completely satisfactory. The ratio of successful launches to what has been termed by some as "successful failures" has not improved very much in the past year. And as soon as we began to plan for second generation experiments we found that we were facing some hard facts of life in the propulsion and guidance fields. Even today, every shot we make—either by the military or by ourselves in NASA—is a shot in which there is little or no margin for even a slight deviation from planned performance parameters. In thrust capability, in guidance-injection, mid-course and terminal—in thrust control—in all of these areas there is much that must be learned and applied before we undertake the difficult missions we all talk about so glibly.

Secondly, it is becoming clear that we cannot and should not attempt to undertake all of the hundreds of projects that are being recommended to advance our understanding of the space environment. We haven't the manpower, the facilities or the funds. More important than any of these, however, is the fact that it seems to me that we will make progress faster if we move at a rate that will enable us to understand a bit more about the things we have already done and the information we have already acquired from successful experiments that are behind us.

Reliability

Probably more than any other single matter, the question that plagues all of us is one of reliability. When will we be able to count on being successful in launching and placing into orbit or on the desired trajectory in deep space as many as three out of four of our intended experiments? We should admit, quite frankly, that with

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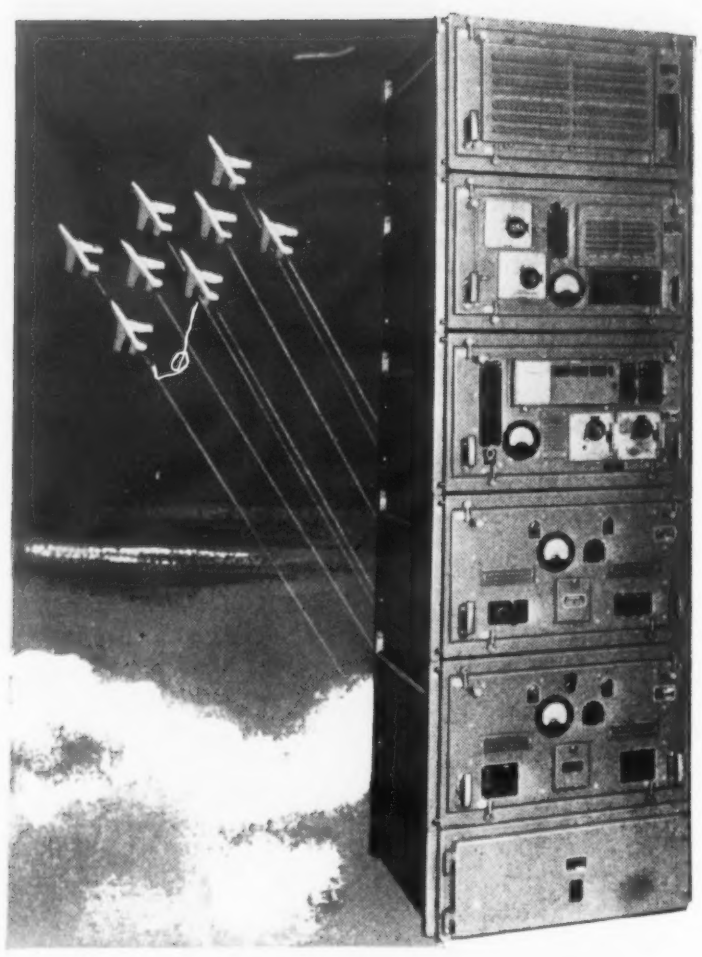
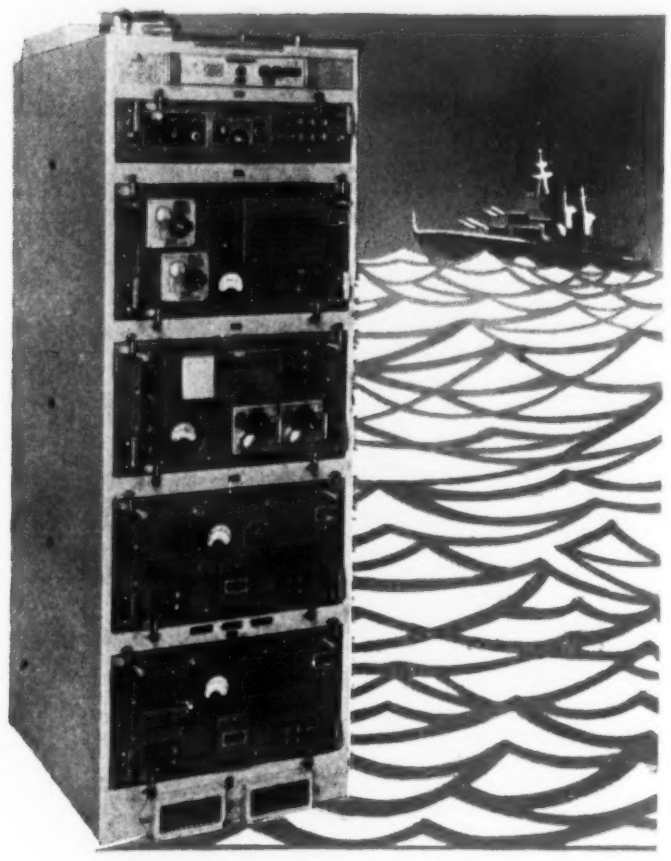
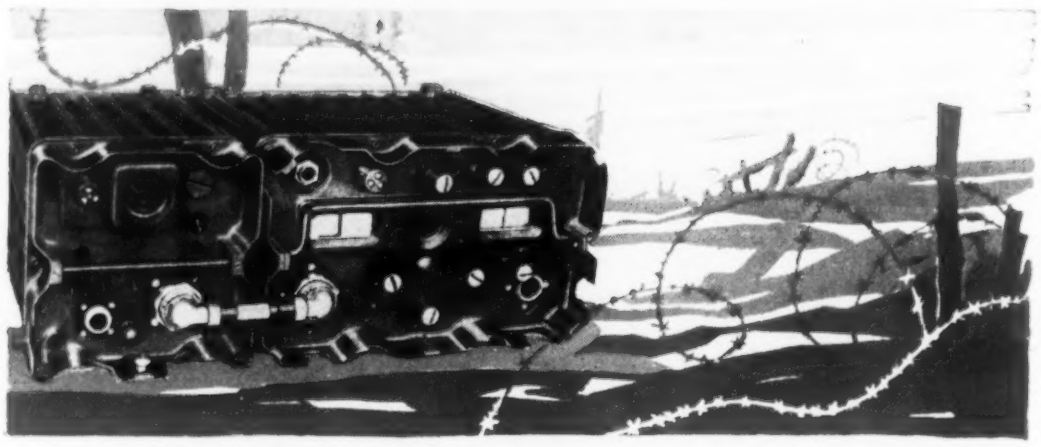


Commanding Voice





Instantaneous, intelligible contact no matter how exacting the conditions—that is the primary requirement of communications in any sphere of offensive or defensive operations.

To meet this need, on the battlefield, in the air and at sea, The Plessey Company, in collaboration with various Government Research and Supply Establishments in Great Britain, has produced a comprehensive range of transmitting and receiving equipment, each specifically designed for its particular application.

For the British and Commonwealth Armies, short-range speech contact to armoured fighting vehicles in the forward areas is maintained with maximum clarity by V.H.F. equipment incorporating revolutionary improvements in electronic and mechanical efficiency. This equipment provides the practical solution to instantaneous communication in mobile warfare.

In meeting the different demands of the air and naval forces, the Company has developed and manufactured Ultra High Frequency equipment, which operates over the whole military UHF band of 225–400 megacycles, providing 1750 as against the existing 560 VHF channels. (A variation is available with 50 Kc/s bandwidth, giving 3500 channels.) Independent of any other form of radio communication activity, it is free from interference and fading and is the most advanced communications equipment of its kind.

For accurate, instantaneous and completely clear communication, the Plessey system of UHF has already been adopted asstandard in the Royal Air Force, the Royal Navy, the Navies of the Commonwealth and is also used by the Naval and Air forces of some N.A.T.O. member countries.

The Plessey Company Limited is able to provide these equipments now to authorities in all parts of the world where thoroughly clear and reliable communications are to play a vital role.

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distressingly few exceptions, we have not achieved complete success in any mission to date—success in the sense that the payload has been injected into orbit or into a deep space trajectory within reasonable limits of the planned flight objectives and in the sense that the payload has performed its mission satisfactorily.

Now lest you think I am being unduly harsh, let me hasten to say that our competitors in the USSR have reported only their successful flights to date. We know they have had failures. We don't know, in any instance, whether even their announced successes have really come any closer to the intended objectives than have ours. And I am mindful of the truly great accomplishments that the United States has managed in the past two years in the space field. Indeed, I am proud to be one of those associated in a responsible way with this national effort where success or failure may well have implications far beyond the immediate civilian or military utility of the experiments we attempt.

We are the one nation in this world which has developed its position of leadership through the application of science and technology to the alleviation of man's back-breaking burdens while continuing to protect the rights of the individual citizen. For us to play second fiddle in this space business is to admit that we have lost a part of our genius for experiment—for taking a competitive risk—for searching out new facts about nature that ultimately will improve the well-being of mankind everywhere. No, we cannot and I am sure we will not fail to demonstrate once again that free men—when challenged—can rise to the heights and overcome the lead of those who build on the basis of the subjugation of the rights of the individual as they dictate to him the path he must take in response to the demands of the state.

Now that may seem to be a bit of histrionics but it is the creed by which we must guide our actions in the days ahead. And we are not going to achieve our goals by wishful thinking about difficult technical problems.

Look At the Future

But I'm afraid I'm being carried away by my own convictions about the basic capabilities that reside in our people while the realities of this business await attention. Having told you very, very briefly about the more important bits of realism that have been impressed upon us during the past year, let me now tell you something of our thinking about the future.

First, as to program—we have had to face up to the fact that we simply cannot do everything that is proposed either by members of the scientific community, other agencies or by our own people. Some of the firing schedules we developed eleven months ago lacked the realism that now characterizes our planning.

Within the next year, I think you will be able to note an orderliness about the attack our people will be making in the space sciences area. Thus far we have been engaged in completing experiments planned for the International Geophysical Year. In fields such as astronomy, meteorology and the physical sciences, we are developing a determined and well planned program. Lead times for most of these experiments will be long and will call for continuing high levels of effort and support. Unless we can achieve this goal, we will lack, ultimately, the underpinning for the entire space program and may miss the really important discoveries that now lie hidden from our view.

We plan to concentrate our initial efforts in deep space on lunar missions—near miss, orbiting and hard and soft landings of payloads. In this program we will develop the techniques necessary to accomplish missions into deeper space and will use them for such missions as their reliability and the opportunity permits.

Second—as to basic research and advanced technology—we expect to support greater effort in the universities, other non-profit institutions, and in industry in both basic research and in advanced development of systems components. In the development of better methods and devices in the fields of guidance, control, telemetry, auxiliary power units and sensors of all types—in all of these areas, we see the need for greater concentration of effort. Through such actions we hope to improve the reliability of the systems which will employ these components.

Third—as to booster systems—it is becoming increasingly apparent that greater effort must be placed on simplification and reliability. As a corollary, it seems quite clear that continued attention must be given to reduction in the number and varieties of rockets and rocket booster systems for use in the space business. It is unlikely that these systems will become off-the-shelf production items in the foreseeable future. With limited numbers of firings in prospect, reliability can be expected only if the variety of systems is kept at a minimum. It will be cheaper to waste payload space in using an oversize booster that becomes reliable through continued use than to tailor boosters for each specific mission with the attendant lowered reliability that surely will result from infrequent use.

As we move ahead in our program, using newly developed vehicles of larger size and with more stages, the problems of achieving successful flights will increase. Recognizing the statistical success thus far achieved with the single- and two-stage missiles and the number of firings required in their development period, we must ask the question as to the probable success of a seven-stage vehicle required to land a man on the Moon and return him to Earth. Clearly, major advances in research and development techniques leading to greater vehicle reliability must be accomplished. Both the cost and development time will be prohibitive if vehicle development depends, as it does now, so heavily on "trial by fire." As a part of our program we are currently studying methods for development that might lead to earlier success of our flight vehicles, and the progress we make here may well determine how long it will take to do the advance missions that we are all so anxious to accomplish.

Finally—as in most other advanced technologies—a vast new area of materials research is being opened up by our space exploration requirements. As you well know, many materials exhibit different properties when used in radiation fields and in the vacuum of space. These materials must be improved or other materials found or developed to replace them. Magnesium, for example, sublimates in a vacuum—and effectively disappears. Another phenomenon—two moving metal surfaces in a vacuum tend to weld together by molecular adhesion. Our engineers and scientists are facing many such problems, but the list is far too long to catalogue here.

My point is simply this: we have used up much of our missile technology. We have drawn heavily on our capital—the knowledge and experience accumulated by the military services, by industry and by NACA and others over the past 10 years or so. We must replenish that capital with new knowledge. From here on out, space research is going to be a matter of the same determined plugging away that has characterized aeronautics research—and, indeed, all scientific endeavor.

As for Russian space achievements, we have learned

(*Continued on page* 35)

1912 — First Automatic Flight — by **SPERRY**

Since Lawrence Sperry first flew automatically, thousands of Sperry automatic pilots have been standard equipment on a wide variety of aircraft – both military and commercial.

NOW...FROM SPERRY

The First Universal Automatic Pilot

REPLACES COSTLY CUSTOM SYSTEMS

A revolutionary 5-pound power unit is making aviation history. This "black box" is a universally adaptable servo system . . . and the heart of aviation's first Universal Automatic Pilot. The building block system will provide precise automatic control for all types of U. S. Army aircraft, including drones. Below the cost of custom-engineered flight control systems, it offers a variety of installation "packages" to achieve exactly the desired degree of flight automation.

DEVELOPED BY SIGNAL CORPS AND SPERRY

More than three years of study and development by the Avionics Division of the U.S. Army Signal Research and Development Laboratory, and Sperry, have gone into the design of the Universal system.

ANY COMBINATION OF COMPONENTS

By means of a small plug-in computer capsule, the system adapts itself to each aircraft type. A universal power unit is installed for each flight axis which it is desired to control: roll, pitch, yaw and throttle for fixed-wing aircraft, plus collective pitch and rotor rpm for helicopters.

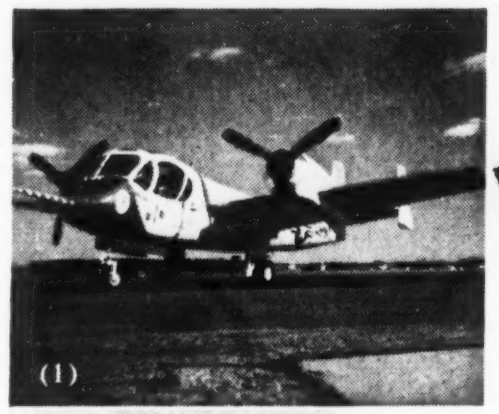
UNIFIED COUPLING

An automatic navigation coupler gears the system to take its commands from such sources as VORTAC, ILS, radar altimeters, Doppler radar, and terrain-clearance radar – selected by the pilot. A special guide line coupler will permit helicopters to be flown "like kites" from the ground.

LOW WEIGHT PLUS EASE OF MAINTENANCE

Weight factor varies with the degree of automation but a full fixed-wing system totals just 39 pounds; the complete five-axis helicopter system, only 54 pounds. Use of the unique "building blocks" simplifies maintenance and significantly reduces the amount of electronic harnessing and other cabling required.

By pioneering the development of the Universal Automatic Pilot, the Signal Corps and Sperry have made a major contribution to airborne technology, logistics, and the entire field of automatic control.



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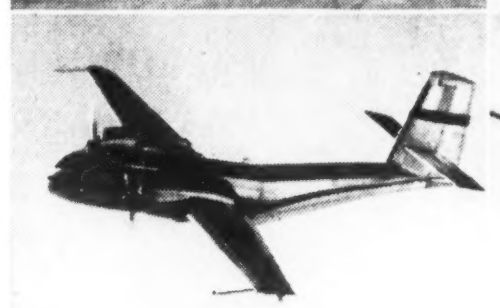

(5)

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(1) Grumman YAO-1 Mohawk (2) Sikorsky H-34 Choctaw (3) Sikorsky H-37 Mojave (4) Beech L-23 Seminole (5) De Havilland YAC-1 Caribou (6) Vertol H-21 Shawnee

SPERRY

SPERRY PHOENIX COMPANY, *DIVISION OF SPERRY RAND CORPORATION, PHOENIX, ARIZONA*

TILT

by CAPTAIN MILES C. VAUGHAN, JR., INF.

THE FIFTEEN HUNDRED MILE radio was working perfectly, then the RF meter skidded over to zero and the set stopped transmitting. It was repaired by the truck driver.

Riding towards the objective in his Jeep, the Colonel's radio went out. Telling the driver to continue driving, the Colonel reached back and fixed it.

On a tank the radio stopped. The squad leader diagnosed the trouble and replaced the defective part.

This was all very simple and commonplace. Every serviceman mobilized in this final world war had received electronic repair instructions in basic training. As I recall, the total time allotted on the training schedule was two hours — probably more than enough.

It all started way back in '57 when the services were yelling for more money to train technicians, and even more money to keep them in service. Neither program worked. More men were trained but a thankful civilian industry gobbled them up as fast as they were trained. Fact—it was the rage in those days to let the services pay for your technical education. You couldn't beat it. You got free food, clothing and shelter, while learning a trade which would pay you an outside starting salary of about a hundred a week.

The additional pay didn't work either. The Army was, and still is, a non-profit organization and couldn't compete with private industry. They tried paying by MOS (military occupation specialty), but this wasn't enough and it wrecked what was left of the NCO prestige program. So the whole drive was a flop and the button pushers in the push button age were running out of serviceable buttons to push.

That's when they took the tip from that line in the *Caine Mutiny*, "Designed by geniuses to be operated by morons," and came up with OPERATION TILT.

TILT saved the day. No technicians were needed below the division level; everyone became a repair man.

Here's what happened when that long range radio went out. The truck driver opened the radio cover and looked in. He saw several rows of cans, each with a glowing neon light; that is, all except one. Reaching in, he pulled out this can which had been attached to the chassis by a group of plugs like a radio tube. He noted the number printed on the can, reached in the spare parts bin, found a can with a like number and replaced it in the radio. The set was again pushing electrons for fifteen hundred miles. The defective can went back to Division for direct exchange.

New idea? Even in 1957? No! This idea had been tossed about in industry for years. Several sets of this type had been patented all over the world. If you read any of the science magazines back in those days you occasionally saw pictures of them. They worked like this. Every piece of electronic equipment, simple or complex, is the combination of several simple circuits, such as detector, oscillator, or amplifier. One circuit, such as the detector, is assembled in a can which plugs into a prewired chassis. The chassis contains only the wires running from can to can. Nothing to short or burn out. The reason this system didn't go over in civilian industry was financial. It would cost more to replace the can than it would for a radio repairman to diagnose the trouble and replace individual parts. Also to have introduced this plan into private industry would have meant that the company, which introduced this system, would have to sell the repair cans to every serviceman in the business before the radio could go on the market. The idea was fine but no repairman was going to lay out money for a radio, not yet on the market, and no individual was going to purchase a radio which could not be repaired.

With the Army the problem was different. First, there was no difficulty with selling the radios — just put them on the Tables of Organization and Equipment (TOE). Second, the repair shops wouldn't hesitate to stock the parts—put out an order. So there was no problem with introducing operation TILT into the Army.

The initial costs were terrific but the Army explained it this way. First, it eliminated all repairmen in the Divisions except a few at Division level. That saved over fifty per cent in personnel tied up in repair work. This saved money and helped out in the streamlining program which went on in '57. Then it eliminated all that test equipment below Division. They really saved money there. Cut down on some trucks too. They had no way of calculating the money saved by doing away with all those spare parts which got lost so easily and sometimes mysteriously disappeared.

That was the thinking behind TILT. Here's how it worked.

When you draw a set of electronic equipment you get the complete set—plus an extra set of cans. One for every can in the set. When the can or circuit is working a neon light is glowing. When the set gives you any trouble, you replace the can in which the neon light is not burning. Shortly thereafter you go to Division for a direct exchange, and you're back in business. Just for the books, those cans which went back to Division are repaired there and placed back in stock. Any improvements which develop are wired into the cans before they go back in stock, and in this way the radio you have now will not be obsolete for a long time to come.

This, then, is the system that solved the big technician shortage back in '57 and is still with us today; of course, we still have sets that are not suitable for conversion to TILT, but our basic combat radios are all under TILT.

Next time you are near your radio, open the lid and read that repair sign. It says, "If neon light not burning—replace can with like numbered can." Boy! Did we go simple in that push button age.

Of course, this hasn't happened, but the question is—why not?

PAGE COMMUNICATIONS, LEADERS IN WORLD-WIDE TELECOMMUNICATIONS, USES "MOON MESSAGE" TECHNIQUES TO LINK THE FREE WORLD

Employing advanced techniques similar to those used to reflect the first complete message off the moon, Page Communications Engineers leads in planning and setting up world-wide telecommunications networks. Recently Page linked the NATO Nations. Over the Atlantic and the Pacific, Page engineered the first transoceanic scatter-propagation networks for clear, long-distance transmission. Page works with all the U. S. Armed Forces, serves on the DEW Line and the Pacific Missile Range.

On the African continent, Page combines troposcatter, telephone, teletype and data communications to link Morocco, Spain, and the United Kingdom. In a joint venture, Page is building a national telecommunications and broadcast system for the Kingdom of Libya. Page, through its affiliate, Edison-Page, is active in Italy. As today's leader in the field, Page Communications continually brings its intercontinental experience to advancing the ever-expanding arts of radio, television, navigational aids, telemetry and wave propagation.

Challenging opportunities are available for qualified engineers.

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DEFENSE and SPACE responsibilities

by
R. A. GALLAGHER
SIGNAL Staff

IN SPACE WORK, the Advanced Research Projects Agency's (ARPA) responsibilities have been lessened and the U. S. Air Force's role has been increased considerably as a result of the recent Defense Department decision calling for the eventual assignment to the Air Force of responsibility for the development, projection and launching of all military space boosters.

As a consequence of this action, certain space projects will be transferred from ARPA to the Army, Navy and Air Force. ARPA will concentrate on long term research in such areas as advanced defense systems against missiles and solid fuel research. The Air Force will assume top authority for space projects while the Army and Navy will be responsible for payloads and ground support equipment for space work.

Of the projects removed from ARPA's authority, the Air Force will have control responsibility for Midas and Samos. Midas is the satellite to be used for early warning against ballistic missiles and Samos is a reconnaissance satellite.

The Army and Navy each were assigned control of one space project formerly under ARPA's jurisdiction. A satellite navigation system, Transit, was transferred to the Navy and a communications system, Notus, was given to the Army.

ARPA retains authority for several space projects—at least for a while. These projects are Courier, Discoverer, Mrs. V, Orion, and Defender.

At the recent dedication of International Telephone and Telegraph Laboratories new laboratory at Nutley, N. J., company officials outlined plans for Project Courier for which ITT Labs has received a subcontract from the U. S. Army Signal Corps, which is the prime contractor, calling for the design and construction of Courier's vital ground communications stations. Under Project Courier, satellite "messenger" will be orbited 500 miles above the earth at a speed of 20,000 miles per hour making a complete round-the-world trip every hour and 20 seconds. Information previously stored in three strategically located ground stations will be received and recorded by the satellite as it passes overhead. When the space vehicle reaches an area within visual range of the station to which messages are addressed, a coded command will direct the satellite to "unload." Courier's ability to provide direct, high-capacity communication between two points separated by as many as 3,000 miles will be achieved through the use of satellites capable of receiving and transmitting radio signals.

The ground stations, while receiving messages stored in the satellite, will transmit back to Courier on a different frequency, traffic destined for other locations. By "sending" at extremely high rates while the satellite is in view of each ground station, it will be possible to have a message-handling capacity equivalent to 20 teleprinters operating continuously at the rate of 100 words per minute.

Economical world-wide television can be made practical through satellite relaying, according to Henri Busignies, President of ITT Laboratories. "This can be accomplished," he said, "by a system for which Project Courier is actually the advance guard." Essentially, this world-wide communication network consists of three durable satellites with active repeaters orbiting the earth in the equatorial plane at an altitude of 22,300 miles. The satellites will orbit the earth at the same rate the earth rotates on its axis; consequently, each satellite will remain stationary with respect to the earth's surface and will have an orbit period of about 24 hours. By stationing one satellite every 120 degrees about the orbit, and three ground stations at Athens, Tokyo and Houston, world-wide telephone, television and teleprinter coverage can be obtained, excluding polar regions. With appropriate ground networks, it will be possible to establish a world-wide telephone dialing system.

As for Project Discoverer, Defense Department officials believe it will be transferred to the Air Force at a later date. Discoverer includes the series of polar-orbiting satellites which are regarded as the military step toward the man-in-space program.

It is not known whether Mrs. V, Orion, and Defender will remain permanently under ARPA's control. It is probable that they will be transferred to one of the Services at a future time. Mrs. V is the program designed to conduct the research necessary to produce a maneuverable, recoverable space vehicle. Orion is the study of the possibility of using controlled nuclear detonations to propel a rocket. Defender is the entire ARPA effort in the field of ballistic missile defense, consisting of more than 50 programs.

Much interest has been focused on Project Saturn as a result of the recent statement by Maj. Gen. John B. Medaris, Commander of the Army Ballistic Missile Agency, to the effect that the project is being delayed by a fund shortage. Work on Saturn, a

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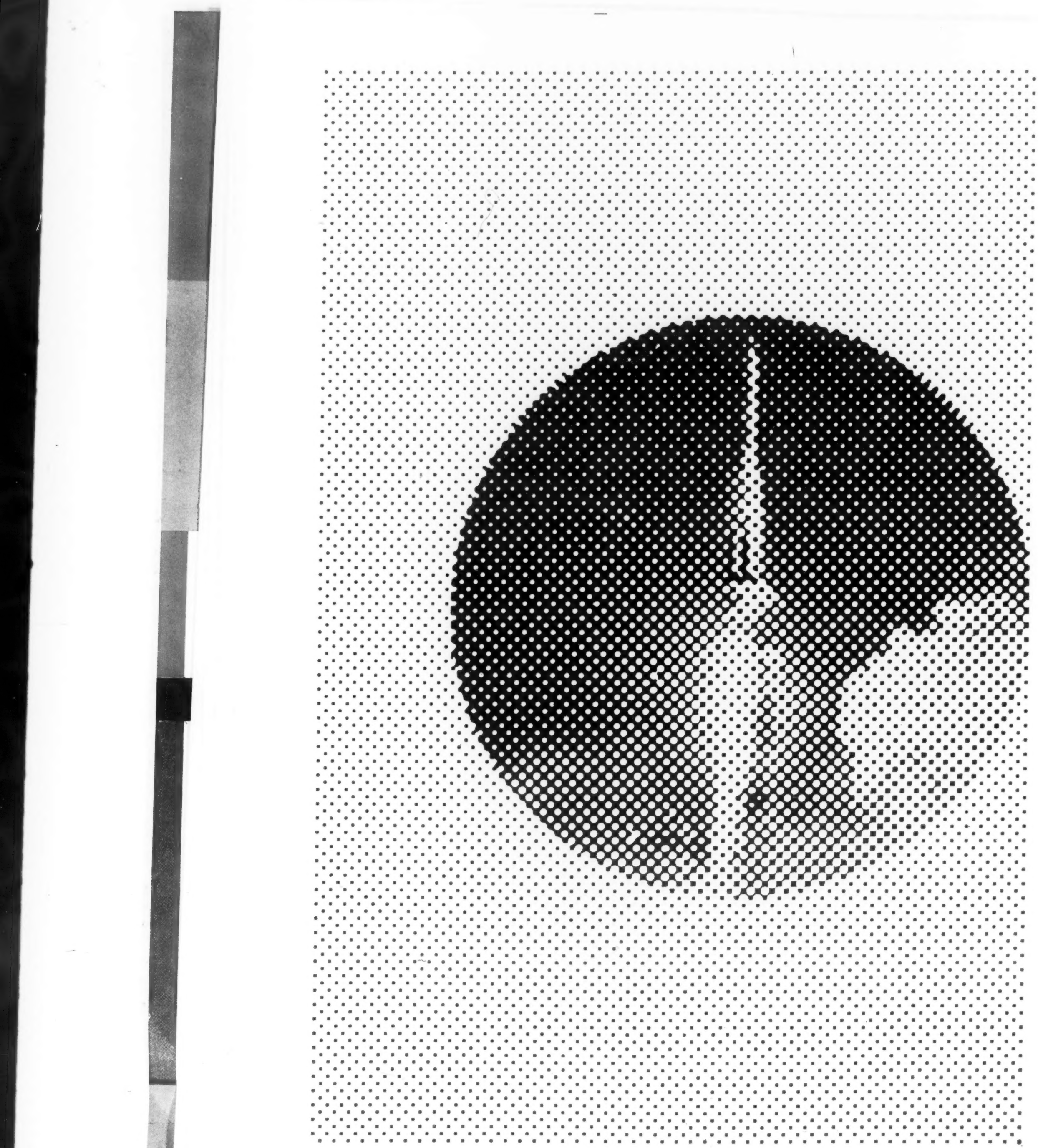


There are 7,500 dots shown here.

This is the number of engineers in the eight divisions of Martin. And 40 percent of these—the 3,000 dots in the circle—are electronics/electrical engineers.

It is this specialized capability that enables Martin to develop electronic systems which anticipate the exacting demands of the missile-space age.

Example: A Martin electronic system known as Master Operations Control (MOC) has been a vital factor in the exceptional performance of TITAN. By automatically checking the hundreds of systems necessary to successful flight, MOC has removed much of the human error from complicated countdown procedures.

MARTIN

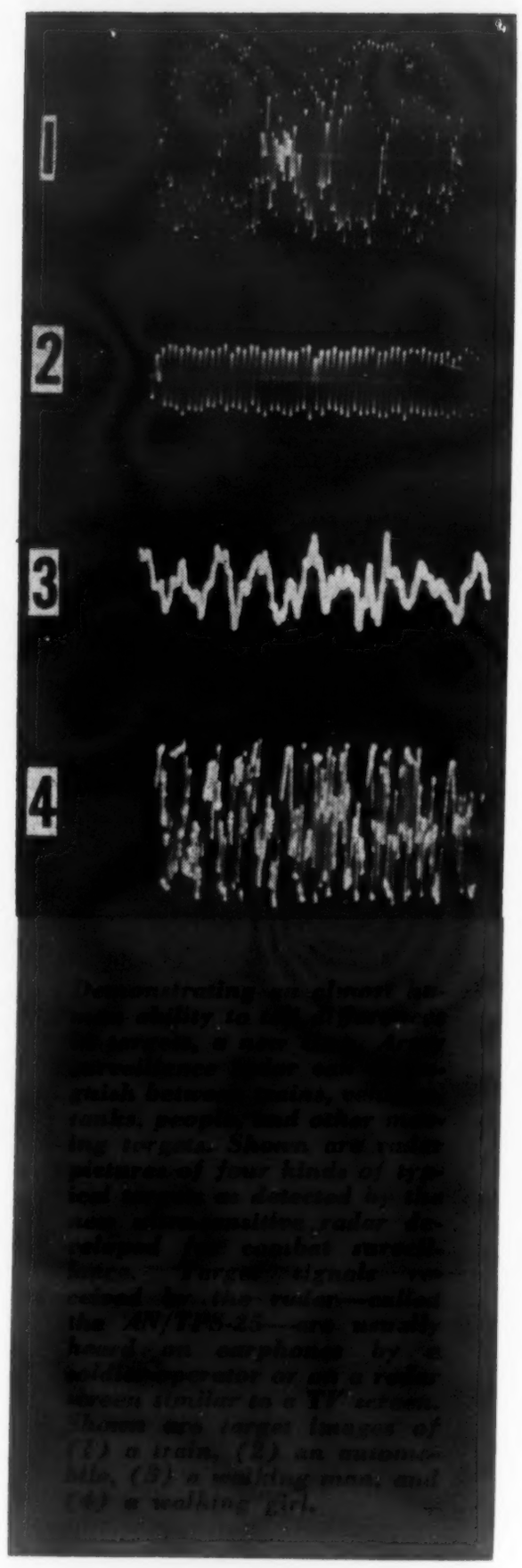
The eight divisions of The Martin Company are Activation, Baltimore, Cocoa, Denver, Nuclear, Orlando, RIAS, and Space Flight.

launching rocket with 1,500,000 pounds thrust, presently is being carried forward by the Army under its contract with ARPA. Congressional approval of recent Executive action will place Saturn under NASA.

It is believed that the Defense Department's "take-ARPA-out-of-space" action was prompted by Congressional evaluation of ARPA's expensive budget. An unconfirmed report states that defense officials are of the opinion that the Services would have a better chance of getting funds appropriated from Congress for the space projects than the space agency. Also, the action was taken to clarify ARPA's position in relation to the work being done by the various Services. While ARPA was created originally to take charge of highly advanced research and development projects, the Army, Navy and Air Force were supposed to be responsible for projects in or close to the production stage. However, it was difficult to draw the lines of jurisdiction. As a result, ARPA and the Services often vied among themselves for programs and funds.

With ARPA being eased out of the space field, it seems only natural that the Navy and the Army should be greatly concerned over the Air Force's increased control responsibilities of space work. Several months ago the Department of Navy submitted a proposal for consideration and action to the Joint Chiefs of Staff for the establishment of a joint space command with the responsibility for the command function rotating among the three Services. Should this proposal be acted upon favorably by the Joint Chiefs of Staff in the immediate future, it may very well affect the reallocation of space projects. As it now stands, both the Navy and the Army figure not only to lose control of some of their work projects to the Air Force, but also there is the possibility that the Navy's Polaris may be affected as was the Army's Ballistic Missile Agency at Huntsville, Alabama, recently.

Under the Defense plan as it now stands, Secretary of Defense Neil McElroy will set the date of the actual transfer of the projects from ARPA to the Services. When the projects are transferred, which should be within a year, the money involved will go to the service selected. The five projects being shifted to the Services account for more than 50 per cent of ARPA's $540,000,000 budget for this fiscal year.



Demonstrating equipment's ability to distinguish between trains, vehicles, people and other moving targets. Shown are radar pictures of four kinds of typical targets as detected by the new all-weather radar developed for combat surveillance. Target signals received by the radar—called the AN/TPS-25—are usually heard as earphone tones by a trained operator or on a radar screen similar to a TV screen. Shown are target images of (1) a train, (2) an automobile, (3) a walking man, and (4) a walking girl.

a new era in the art of combat surveillance through INDUSTRY-MILITARY COOPERATION

by RICHARD L. BEAM
Executive Vice President
Hazeltine Electronics Division
Hazeltine Corporation

Additional remarks by Brigadier General W. M. Thames, Commanding General, U. S. Army Combat Surveillance Agency

FOR SOME YEARS now, companies in the electronics industry working in harmony with the military services and their development laboratories have created equipment and systems which have contributed immeasurably to the advancement of the art.

Hazeltine has been proud of its roles in such achievements in the IFF, anti-submarine warfare, airborne early warning, data processing and computer, ground radar and other fields.

The Army Combat Surveillance Agency's newest front-line radar set, the AN/TPS-25, is a current example of the effectiveness of close cooperation between industry and the military services. In this case, Hazeltine Electronics Division under the guidance of the United States Army Signal Research and Development Laboratory, designed, developed and produced a high-powered, ultra-sensitive radar which, according to the Army's Deputy Chief of Staff for Logistics, "heralds a new era in the art of combat surveillance."*

Tests at the United States Army Electronics Proving Ground at Fort Huachuca, Arizona, proved that our engineers accomplished their objectives—high reliability and accuracy of target acquisition up to 20,000 yards. The TPS-25 is operable in all weather and in darkness unpenetrable by the human eye. Through an aural presentation, this doppler pulse radar can detect and distinguish between various moving targets, including a walking or crawling man, a vehicle, a tracked vehicle and a train as well as groups of these targets. The portion of energy received from a moving target is shifted in frequency through the doppler effect. The resulting frequency shift produces a tone which is presented aurally to the operator. Various component tones, such as those produced by the movement of arms and legs of personnel and the tracks or wheels of vehicles, are also heard by the operator. An experienced operator can differentiate between various types of targets by recognizing their characteristic sounds.

Much publicity has been given to this radar's ability to distinguish between men and women walking at great distances. This is possible because a woman's steps are normally shorter and quicker and her movements more complex than those of a man, and the set is sensitive enough to distinguish the differences. (See figure 1)

The excellent tactical performance of the TPS-25 has been demonstrated under actual field conditions; and, according to the Army Combat Surveillance Agency, these sets are currently in field use overseas. This radar is not only capable of detecting and distinguishing targets at long range, it can locate them as well. An analog computer is utilized to present accurate target location on digital counters. The radar is normally operated in a mode which automatically searches an assigned area for an aural indication of target movement such as infiltrating troops or vehicles. By the use of appropriate controls, the operator can track and pinpoint the detected movement.

An oscilloscope and automatic plotting table are also provided as operator aids. The oscilloscope displays both fixed and moving targets in a 1,000-yard range segment under surveillance. It also indicates a gate designating the 80-yard segment being examined at any given time. The area being scanned by the radar can be observed through a moving spot of light which shines through the standard Army area map on the plotting table.

Transportable in its shelter by helicopter, truck or small two-wheel trailer, the radar can be placed in operation by a four-man team in approximately a half hour. A three-section, 25-foot high antenna mast and remoted cables provide freedom of choice of antenna site commensurate with terrain conditions.

Power is provided for the radar set from a 3 kw. 400 cps generator. The peak pulse energy power radiated from the antenna is 42 kw. This

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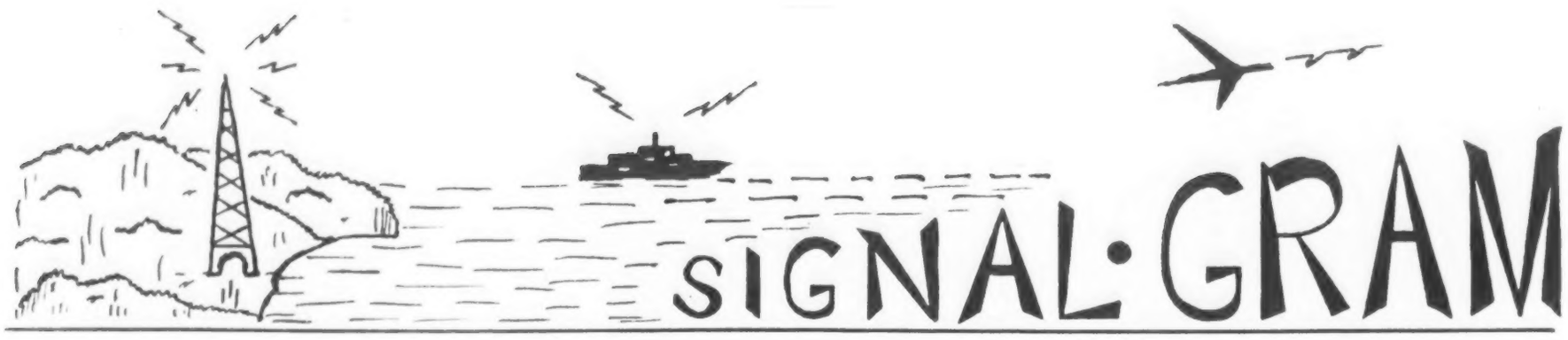
Lt. General Carter B. Magruder, testimony before House of Representatives Defense Appropriations Sub-Committee, May 1959.



— GOVERNMENT —

THE FIRST U. S. MOON-ORBIT SHOT may be attempted in the early part of November, when the moon is at its closest distance to the earth if preparations can be completed by then. The shot will use a new guidance system called AGS, or Advanced Guidance System. The late September explosion of an Atlas-Able rocket on its Cape Canavaral launching pad cancelled United States' hopes to put a vehicle into orbit around the moon during early October to match Russia's successful moon shot which heralded Khrushchev's visit to this country.

U.S. WILL LAUNCH TEN RESEARCH ROCKETS THIS MONTH in connection with International Rocket Week, November 16-22, according to the National Academy of Sciences. The research rockets, part of the United States program for International Geophysical Cooperation-1959, will include four from Wallops Island, Va.; three from Fort Churchill, on Hudson Bay in Canada; two from Eglin Air Force Base, Fla., and one from White Sands, N. Mex.

U. S. ATOMIC AIRCRAFT PLANS have received top priority from the Senate-House Atomic Committee. The Congressional group urged that the United States speed up its efforts to put a nuclear-powered plane into flight as soon as possible in order to "provide a boost to world confidence in America's scientific capability." The Committee suggested that the Atomic Energy Commission be given full authority for conducting the atomic aircraft program. Up to now responsibility for the program, which has been carried on for the past 13 years on an on-and-off basis, has been shared by the AEC and the Defense Department.

AIR FORCE ARDC will be realigned, according to Lt. Gen. Bernard A. Schriever, Air Research and Development Command Commander. The principal features of the realignment are a streamlining of the headquarters, and a functional grouping of the centers and sub-commands. The headquarters will have six principal divisions: plans, research and engineering, intelligence, material, personnel and comptroller.

NAVY SCIENTISTS STUDY SOLAR X-RAYS detected during a recent series of rocket shots from Point Arguello, Calif. According to Dr. Herbert Friedman, Superintendent of the Naval Research Laboratory's Atmosphere and Astrophysics Division, the X-rays are generated by extremely hot areas located in the corona of the sun and have energies up to 80,000 volts. Instruments in two-stage Nike-Asp rockets were used to conduct the twelve shots, eight of which were successful.

FAA TO DIRECT AIR TRAFFIC CONTROL now handled by the military services, according to E. R. Quesada, Federal Aviation Agency Administrator. The transfer, which will take about two years to complete, will bring a reduction both in personnel and funds needed to keep the air stations in operation. Designated as Project Friendship, the transfer is in line with the Federal Aviation Act of 1958 which established the FAA as an independent unit to develop and operate a unified military-civilian air navigation and traffic control system.

A CHANGE AT USAF AIR MATERIEL COMMAND'S AERONAUTICAL SYSTEMS CENTER has placed staff production responsibility over more than 30 weapon and support systems under the control of the new Directorate of Production. Headed by Colonel W. R. Carter and staffed by about 30 people, this Directorate will assure that the systems are produced on time with consideration given to reliability and economy.

NASA PLANS FOR ASTRONAUTS have been changed. The National Aeronautics and Space Administration has decided against firing an astronaut 1800 miles out across the Atlantic in an Atlas ballistic missile. Instead, the first American space man will go from short-range test flights in Redstone rockets to full-scale satellite launchings with the Atlas ICBM. The Redstone rocket launchings tentatively are scheduled to start next spring.

NAVY'S "BIG DISH" and reported to be the world's largest radio telescope is being erected in Sugar Grove, West Virginia. Called the Naval Radio Research Station, the 20,000-ton facility will enable the Naval Research Laboratory scientists to tune in radio signals emitted by stars as far as 38 billion light years out in space. Scheduled for completion in 1962, the telescope will be electronically controlled. The largest radio telescope now in operation is located at Jodrell Bank, England.

PENTAGON ACTION ON HIGH-ENERGY FUEL PROGRAMS has resulted in the shutdown of a large, high-energy boron fuel plant in Buffalo, N. Y., which Olin Mathieson Chemical Corp. was to operate for the Air Force. Another high-energy plant that Callery Chemical Corp. operated for the Navy in Muskogee, Okla., is being retained on a stand-by basis. These actions follow recent cancellation of high-energy fuel programs being developed for the B-70 bomber and other future weapons.

NASA LITTLE JOE BOOSTER ROCKET hoisted a dummy space capsule with an inert escape rocket system to an altitude of 40 miles above the Atlantic in its successful first launching, October 4, from the National Aeronautics and Space Administration's research station at Wallop's Island, Va. Neither the dummy capsule which is similar to the one that will carry the astronauts, nor the escape system contained instruments. A 24-foot, 30,000-pound rocket, the Little Joe is being used in unmanned, non-orbit tests.

AN AIR FORCE RADAR ANTENNA to warn against enemy air attack is being tested for use with the nation's Semi-Automatic Ground Environment (SAGE) defense network. Developed by Raytheon Co., for the Air Force, the rotating 50-ton system is one of the Air Force's most modern "heavy-weight" radars designed to feed advanced warning data into a central combat center, according to the Defense Department. Final system tests are expected to begin shortly at Houma Air Force station, La.

CONTRACTS: ARMY: Raytheon Co., supplemental engineering services and ground support equipment for the Hawk missile, $30,162,502; Martin Co., continuation of work on the Pershing solid propellant surface-to-surface missile system, $24,000,000. NAVY: McDonnell Aircraft Corp., production of F4H-1 all-weather fighter jet aircraft, $137,600,000; Lockheed Aircraft Corp., production of P3V-1 turbo-prop anti-submarine warfare landplanes, $67,800,000. AIR FORCE: General Electric Co., production of Thor IRBM nose cones, $29,000,000; Sperry Gyroscope Co., production of APN-59 radar equipment for use in Strategic Air Command's jet tankers, $5,250,000.

— INDUSTRY —

WESTINGHOUSE ELECTRIC CORP. received the first Mamie Doud Eisenhower Award for contributions to nuclear propulsion. The award was presented to Mack W. Cresap, Westinghouse President, on October 16, in recognition of the pioneering work done by Westinghouse which "made it possible for the United States to be first in the vital field of nuclear marine propulsion." To be given annually, the award commemorates the christening by Mrs. Eisenhower last July of the Savannah, the world's first nuclear merchant ship.

CONVAIR, DIVISION OF GENERAL DYNAMICS CORP. has announced that the Air Force B-58 Hustler, which the company built, can avoid radar detection by flying within 500 feet of the ground. Going 700 miles per hour, the Hustler recently made such a ground-hugging flight from Texas to California. The test shows that the B-58 has "penetration capabilities greater than any other aircraft in existence," said Frank W. Davis, manager of Convair's Fort Worth, Texas, plant.

EWEN KNIGHT CORP. dedicated a new 30,000 square foot installation at East Natick Industrial Park, Mass., recently. Designed by Cerel-Perini Associates, Inc., the plant will provide advanced facilities for the company to manufacture receivers and radiometers for use in receiving signals from other planets. One of the current Ewen Knight projects is a radio sextant, which will navigate a ship using radio frequency radiation from celestial bodies.

PERKIN-ELMER CORP. West German subsidiary has received a $30 million contract to produce Sidewinder infrared guided air-to-air missiles for NATO nations. Bodenseewerk Perkin-Elmer & Co. will assume full systems responsibility for the program and will handle directly about a third of the contract including production of the guidance systems, assembly and test of the missile.

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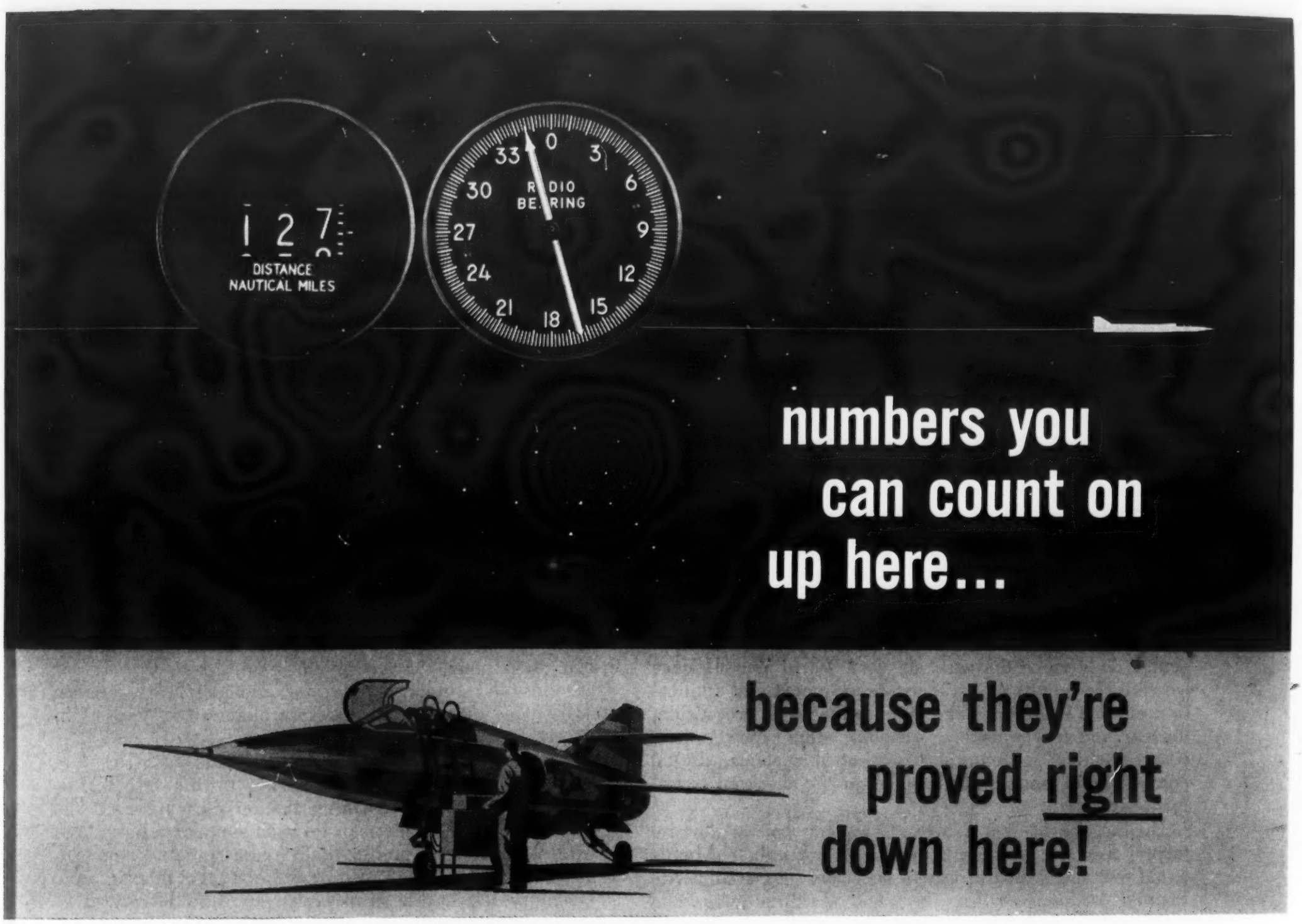
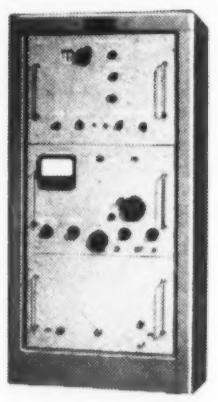
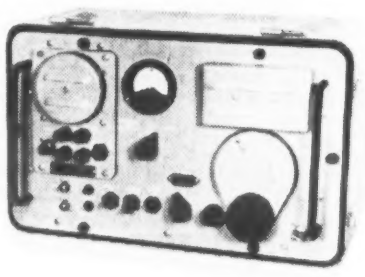


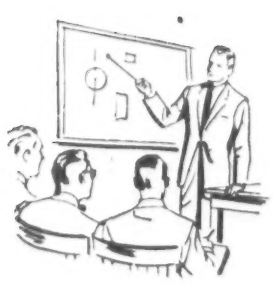
Hoffman test equipment checks TACAN accuracy—on the bench or in the cockpit*



HLI-103 BEACON SIMULATOR duplicates all functions of the AN/URN-3 surface beacon. Tests ARN-21 for full azimuth and entire range, closure and departure speeds, surface beacon identity tone and decoding functions. For bench test or cockpit check. Available on 60-day delivery.



HLI-119 TACAN TEST INSTRUMENT. Portable unit tests *accuracy* of ARN-21 airborne TACAN in the cockpit of aircraft on the ramp or carrier deck. Checks accuracy of range and bearing at pre-set points and identification signals. Availability on request.



TRAINING SCHOOL Classes on use of Hoffman TACAN test equipment are now in progress at the Hoffman plant, and qualified field personnel are available to conduct class instruction at operating sites or bases.

TACAN tells the pilot *which way* and *how far* to his base, station, or carrier in any kind of weather—a good reason why his AN/ARN-21 performance must be next to perfect.

To maintain the high degree of accuracy engineered into airborne TACAN equipment, Hoffman Laboratories has developed specialized test equipment to check function and accuracy on the *ground*—before a flight or after repair.

Compact and rugged Hoffman simulators can be carried and installed as standard test gear to every operating site or repair station—military, commercial, government or private installations. Write for further details.

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HOFFMAN LABORATORIES DIVISION / 3740 South Grand Avenue, Los Angeles 7, California

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Significant developments at Hoffman have created positions for scientists and engineers of high calibre. Please address inquiries to Vice President, Engineering

by HENRY W. PHILLIPS

THE EVOLUTION OF A NATIONAL DEFENSE WEAPON SYSTEM

Manager, BMEWS Operations Administration
Radio Corporation of America

APPROXIMATELY 80 PER CENT of the products and services furnished to present-day weapon systems by the electronics industry were not available as recently as 10 years ago. This is not surprising when we consider the evolution of the weapon system concept and the rapid development of new electronic and mechanical components. Only since the early days of World War II have we seen the results of advanced development and application of such techniques and equipments as jet propulsion, nuclear and thermonuclear weapons, atomic power, missiles, satellites, automatic fire control systems, digital computers, automatic displays, automatic checkout equipment, and many others.

During World War I, weapon systems, as we now interpret the term, were unknown. Officers evaluated battle situations and issued orders to men who took action with manual weapons—rifles, bayonets, machine guns, and artillery. As a result, military operations were slow and inefficient by our present standards.

Shortly before and during World War II, techniques and equipment were refined so that effective electronic weapon systems became a reality. The first such system involved antiaircraft weapons. Antiaircraft guns were controlled manually or semi-automatically, based on information obtained from sound and optical trackers, search-lights, computers, and gun directors. Unfavorable weather seriously hampered operations, however, and search-lights revealed the position of antiaircraft units. The development of radar radically changed the system. Detection became possible under all weather conditions and at ranges of several hundred miles. The next step electronically united the radars, computers, and guns for accurate fire control. This, then, was a simple integrated weapon system.

Many other achievements occurred during World War II that led to complex weapon systems: advanced jet aircraft engines were developed; guided missile work was begun; advanced fire control systems were developed for ground, shipboard, and airborne applications, and nuclear energy was harnessed as a weapon and as a source of power.

Since the end of World War II, some of the greatest advances in the defense program have been accomplished in the electronics field. Radars, computers, and communication equipment have been greatly refined. Transsistors, printed circuitry, and microminiature modules have contributed tremendously to our superior electronic equipment. Undoubtedly, the development and application of miniaturized electronic components is helping us to maintain our position as a world leader in perfecting weapon systems.

A specific development by the Radio Corporation of America in recent years has been the *Bumblebee* precision tracking and guidance radar. The radar was the result of a program that RCA undertook shortly after World War II for the Applied Physics Laboratory of Johns Hopkins University. Tests on the equipment proved that its extreme accuracy made it suitable as a precision tracking and guidance radar for guided missile systems. *Bumblebee* then became the forerunner of several high-accuracy radars.

Figure 1 illustrates such a radar (AN/FPS-16) that has been used in tracking missiles during test flights. Data obtained from tracking the missiles are recorded in such form that they can be used immediately without extensive, time-consuming data reduction and analysis. The Naval Research Laboratory has found this radar to be the most accurate of its type ever to be developed.

This and similar instrumentation radars have been ordered for use at many United States missile test ranges, including Cape Canaveral, White Sands Missile Range, Naval Air Missile Test Center at Point Mugu, and Naval Ordnance Test Station. The radars could also be adapted to serve as flexible surveillance radars by scanning through a selected sector to provide desired coverage.

Another example of the application of precision radar can be found in the tracking radar of the TALOS Defense Unit. The radar is installed in an evaluation system at White Sands Missile Range to track and illuminate targets during system operation.

The process of adapting the Talos missile for land use in the defense unit, originally conceived for the Air Force, was undertaken by RCA and the unit installed in 30 months at White Sands as an evaluation unit. Now operated by the Army, the unit includes two tracking and illumination radars, four guidance radars, two missile launchers with missile magazines, and support equipment.

During system operation, the only necessary personnel required for operation are in the Fire Control Room. The operators in the room merely monitor the system's operation during the fully automatic mode of the system. The human-engineered consoles permit constant monitoring and immediate action to inject elements of human judgment by the operators if they deem such action to be necessary. The automatic mode permits automatic target acquisition and destruction. Tests on target drones have revealed that automatic operation of the system provides high fire power, great accuracy, high kill probability, and excellent reliability. With its automatic checkout equipment, the system can be checked out in about 15 minutes, whereas normal checkout would require several

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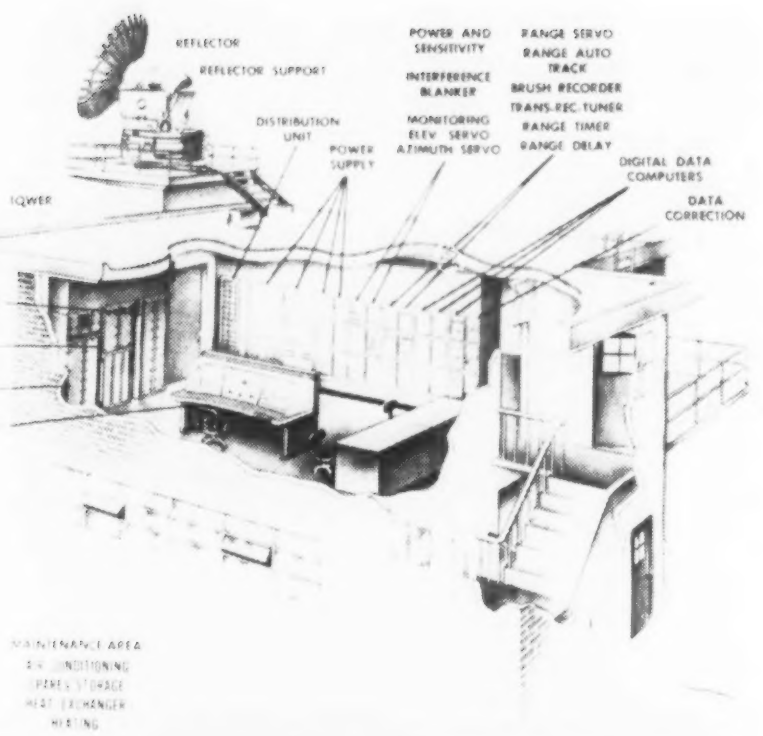

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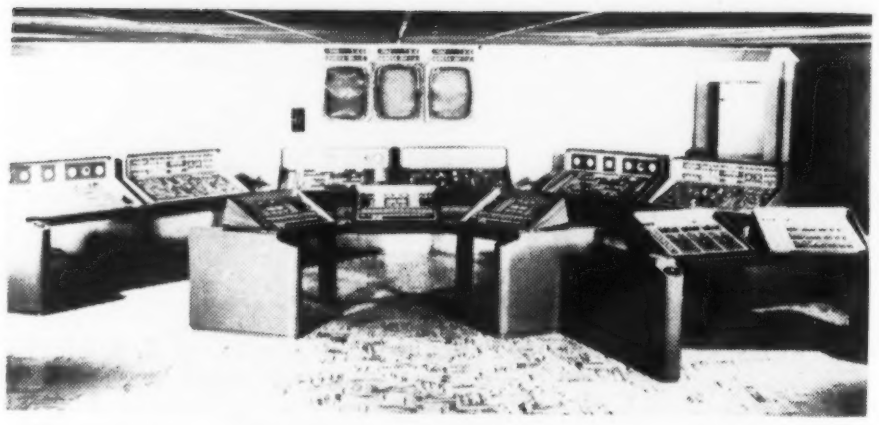

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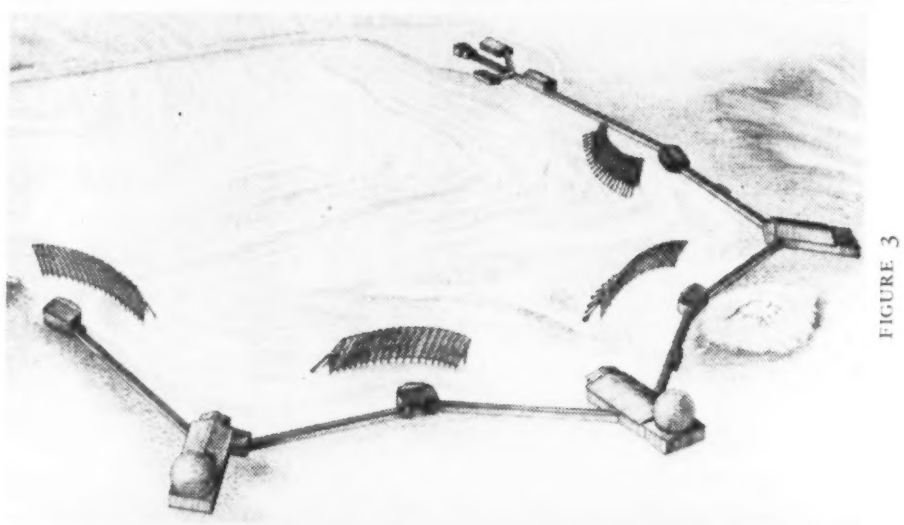

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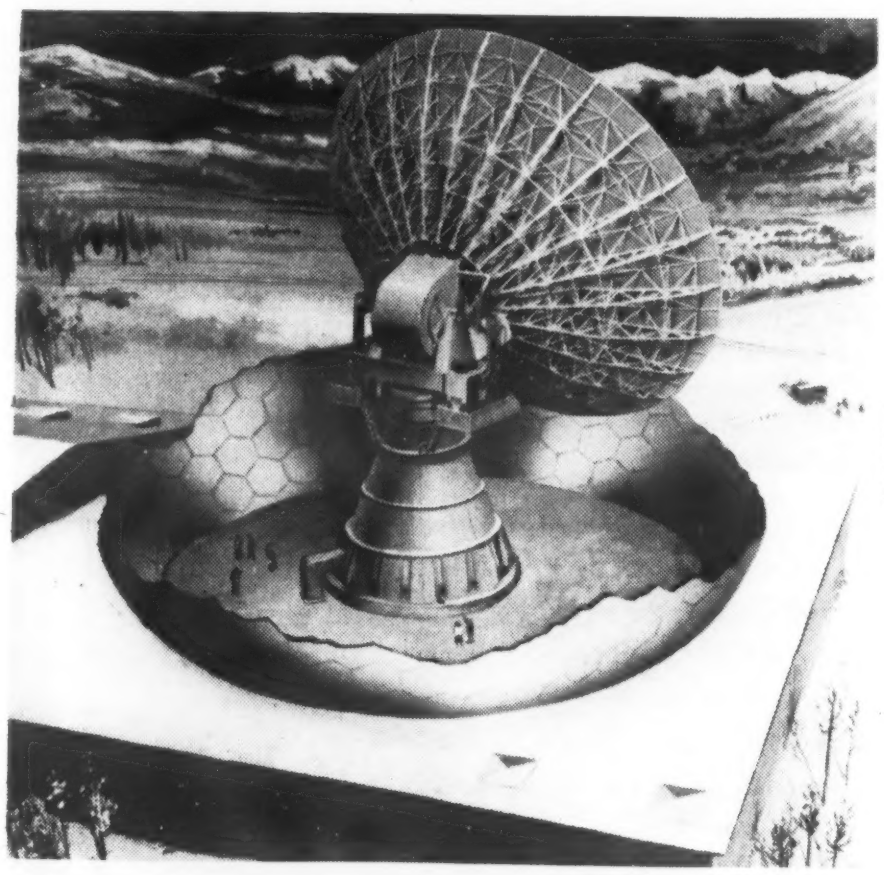

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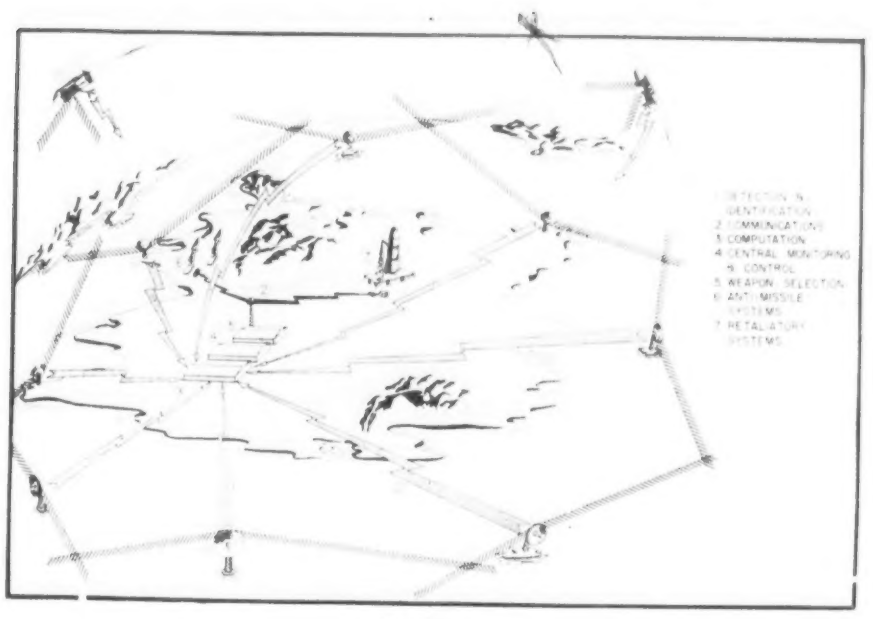

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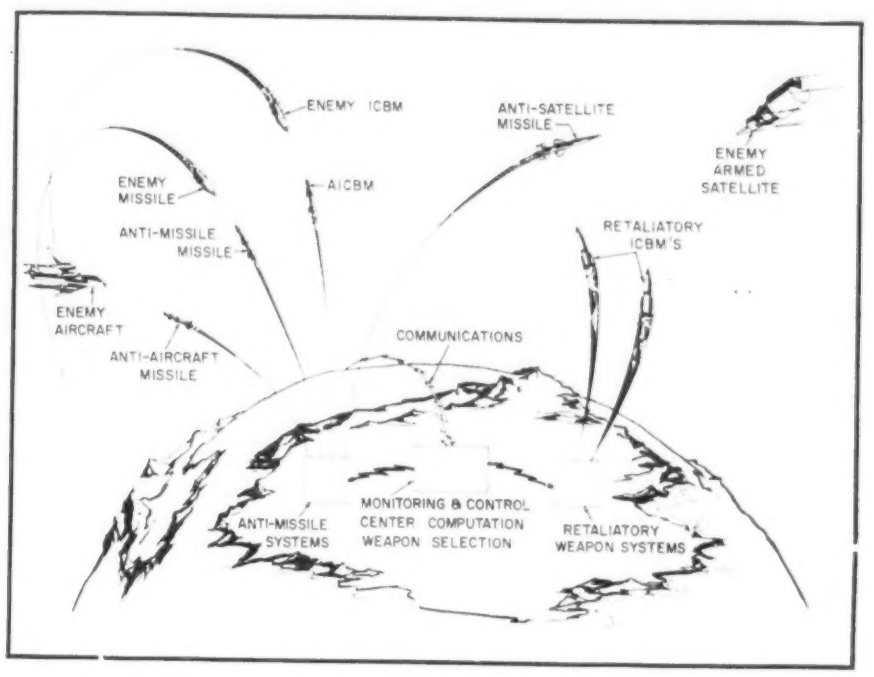


FIGURE 6

(Figure 1) Precision Instrumentation Radar—the most accurate of its type ever developed. This type radar is being used at many U. S. missile test ranges, including the White Sands Missile Range and the Cape Canaveral Range, to track missiles during test flights. This radar can also be adapted to serve as a flexible surveillance radar by scanning through a selected sector to provide desired coverage. (Figure 2) Atlas Checkout and Control Center. This represents the nerve center of the fire control and automatic checkout equipment for the Atlas missile. (Figure 3) Typical BMEWS Northern Site. A combination of high power, long range, surveillance and tracking radars are used to provide complete coverage and positive identification of any attacking ICBMs. (Figure 4) BMEWS precision tracking radar with radome partially erected. This long range radar system was developed by the Missile and Surface Radar Division of RCA at Moorestown, N. J. Constructed by Goodyear Aircraft Co., the antenna is 84 feet in diameter and is enclosed in a 140 feet diameter radome. This radar can be used as a flexible surveillance radar by scanning back and forth through any selected sector. Also, it can precisely track missiles and other objects to obtain accurate data. (Figure 5) Diagram of Defense System Concept. Detection and identification radar equipment with overlapping coverage are shown completely surrounding the country to be defended. Communication links are shown to forward data to a center where computation, control and monitoring and weapon selection functions occur. Other communication links to antimissile and retaliatory systems are shown. (Figure 6) Defense System in Operation. For defense against an ICBM attack, three events must occur in a matter of minutes: (1) The attack must be positively detected at an early stage; (2) Defensive action must destroy enemy vehicles before they destroy their targets; (3) Retaliatory action must neutralize enemy bases to prevent further attacks. This illustration shows an automatically coordinated defensive and retaliatory battle under close human monitoring.

National Defense Weapon System

(*Continued from page 24*)

hours.

On major weapon systems, several defense contractors usually support one another in perfecting the system. Figure 2 shows a mock-up of the ATLAS Control and Checkout Center being developed by RCA under a subcontract from Convair. This room will be the nerve center of the fire control and automatic checkout equipment being produced by RCA for the ATLAS missile.

Early in 1958 the Air Force announced that RCA had been designated as weapon system contractor for the design and construction of a Ballistic Missile Early Warning System (BMEWS). Because of the development of ICBM's, it has become necessary to construct a high-power, long-range radar system with a series of forward sites at northern locations to detect any enemy ICBM's that may be launched toward the United States or Canada. Figure 3 is an artist's conception of a forward site with detection and tracking radars and support buildings. Figure 4 shows a typical tracking radar with radome partially erected. A polar projection immediately reveals why the forward sites are to be located in northern regions; the shortest missile trajectories from the USSR to the United States are across the polar area. Typical approximate distances to principal U. S. cities include 3000 miles to Los Angeles from Siberia, 4000 miles to Chicago from Siberia, and 4500 miles to New York City from northwest Russia. All of these distances are within the range of present ICBM's.

In developing BMEWS to warn of ICBM attack, RCA is supported by several major subcontractors, including the General Electric Company, Sylvania Electric Products, and the Goodyear Aircraft Corporation. Rearward communications are being supplied by Western Electric Company under separate Air Force prime contract. Construction will be accomplished by U. S. Army Corps of Engineers. Such a combination of talents and facilities indicates the complexity of the system as well as the teamwork that exists within American industry on defense contracts.

Factors with a Major Bearing on Future Systems

Several factors having a major bearing on future weapon systems have been revealed during recent years. First, private industry and the Armed Forces have proven their ability to develop, test and operate fully automatic advanced weapon systems. Second, jet engines and rocket motors have provided vehicles with speeds up to Mach 20 so that ICBM speeds of 15,000 miles per hour can be expected. Third, advanced electronic techniques have rapidly improved tracking and detection radars, automatic data transmission and communication links, miniaturization, and automatic checkout equipment.

A future defense system, based on the above factors, involves several special considerations. (1) An extremely short time would occur between the first warning of an attack and completion of the attack. This time can be estimated to be less than 30 minutes. (2) The short time would limit human action and necessitate a completely automatic defense system. (3) Human action would be limited to observing and monitoring the automatic system performance with push-button over-ride controls. (4) The system must operate continuously and must be self-checking.

The basic functional requirements of an advanced defense system include detection and identification, communication, centralized monitoring and control, computation, weapon selection and weapon action. All of these functions, except monitoring, must be automatic. While the monitoring will be performed by humans, the monitor displays will be automatic.

Figure 5 shows a simplified diagram of a theoretical defense concept. Detection and identification equipments with overlapping coverage are located on the periphery of the area to be defended. These equipments consist of extremely high-power, long-range, high-capability radars which may be supplemented by surveillance satellites. Communication links connect these outposts to a central point containing computation equipment, central monitoring and control, and automatic weapon selection equipment. The weapon selection equipment will choose between two types of systems—antimissile systems and retaliatory systems. It should be noted that several types of antimissile and retaliatory systems will be geographically distributed for maximum operation capability.

Figure 6 pictures the defense system in operation. Communications from forward outposts indicate an attack and transmit information on types, numbers, and courses of attacking vehicles. Computation and weapon selection are performed in the monitoring control center. Weapon selection can determine which antimissile system should be used—antiaircraft missiles, antimissile missiles for intermediate and short-range missiles, AICBM's, or antisatellite missiles to destroy armed enemy satellites. Retaliatory action must also be initiated to destroy enemy launching sites to prevent further attacks.

For defense against an ICBM attack, then, three events must occur in a matter of minutes: (1) the attack must be detected at an early stage; (2) defensive action must destroy enemy vehicles before they reach their targets, and (3) retaliatory action must neutralize enemy bases to prevent further attacks.

If we are to defend ourselves against an ICBM attack, we must employ a defense system similar to that described above. Such a system can be developed within our present philosophy of advanced weapon systems.

Although the system would be highly automatized, the role of the human would be all important. He would perform a function that can never be assumed by machines. He would monitor the system's operation and inject human judgment into the system operation. As in the past, the skilled operator would be the most important element in the defense system.

Did you miss the important service AFCEA is offering on page 5? Be sure to turn back and read about the introductory Christmas offer which entitles AFCEA members to send gift memberships to friends for only $4.00.

THE NORTHEASTERN STORY

by
Lt. Col. James J. McKenna*
SigC

WHAT IS AN AFCEA Student Chapter? It is a combination of many things, all adding up to a sense of accomplishment and satisfaction. At Northeastern University in Boston, we have a Student Chapter and it has blossomed and flourished over these past 5 or 6 years. What makes it tick? There is no pat answer; but the enthusiasm of youth, properly guided, is certainly the most important single factor. Late adolescence and early manhood is a many splendored thing—drive—interest—lassitude—curiosity—and other components.

In a young man's life, you cannot accurately predict the state of his mind at any one time. However, if you can appeal to him as part of a group, you will have a response that is both gratifying and productive. We like to think we have done well because we have been fortunate in generating more than an average amount of curiosity, drive and interest in our Chapter members. Possibly, this accounts for the continued growth of this active student chapter.

At Northeastern, which has mostly Signal Corps ROTC cadets, we put our case to them in terms of AFCEA being the professional society of the Signal Corps, and that there is a great deal of benefit to be derived by the individual by associating himself and becoming active in the Student Chapter of AFCEA. During the past year, we have concentrated on the lower classmen and the results have been very satisfying. A recruiting talk by a faculty advisor who transmits on their frequency gets the best results. We also sell the socializing value of the Chapter.

Students from the different colleges in the University and from different classes mingle and meet each other at our weekly Wednesday meetings; sometimes sharing a "field trip" to an interesting industry or activity starts a friendship that will endure through college, and working in the same committee may start a lifetime friendship. Otto Persson, a Liberal Arts student and a "ham" on the side, said "I am glad to be a member of AFCEA, I get a great deal out of it as it offers me the chance to talk about my electronics hobby and work with students coming to Northeastern from other colleges. My regular college courses do not cover this field. Working with AFCEA has made many friends for me."

What are the committees? We have an Electronics Committee and a Photo Committee. Sometimes there is more backing and filling than there are results; however, learning and maturation are going on all the time. We have produced a twenty minute motion picture with sound that, for the actual expenditure of funds (about $25) and the amount of ingenuity displayed, represents a sterling achievement in itself. The film depicted ROTC life at Northeastern and was a well done documentary. The students who produced it gained invaluable experience on which the Army is capitalizing during their military tours. Another motion picture project may materialize in the near future from the fertile minds of the students. In addition, the Photo Committee works with still pictures and processing.

Our Electronics Committee has busied itself with many projects; many of which were of practical value and a source of satisfaction. All of the projects have acted to mold the group of young men into a cooperative entity, glad to have been associated with each other.

How do we arouse and maintain interest? Initially, we depend on personal contact to interest the student in becoming a member. This is done by a talk to the students in their classrooms. The benefits and values of AFCEA are brought to their attention: an AFCEA brochure and a copy of the program for the current term, as well as application cards, are distributed. In addition, copies of SIGNAL are displayed and the magazine's value is stressed. By careful scheduling and planning, in which the students express their preferences, a program is arrived at which has the proper balance and appeal to the interests of the members.

What kind of field trips? Something with a military flavor seems to appeal. Since Northeastern is on the cooperative plan of education, wherein upper class students alternate ten week periods in the University with periods of equal length on regular paying jobs in business and industry, we have in effect two student bodies. This means that we have two similar field trips each year to accommodate Division "A" and Division "B," as the two student bodies are known. We might add that a field trip is accomplished during the day between the hours of noon and two: this limits us in some ways. However, the maximum value is obtained from this short period by careful planning.

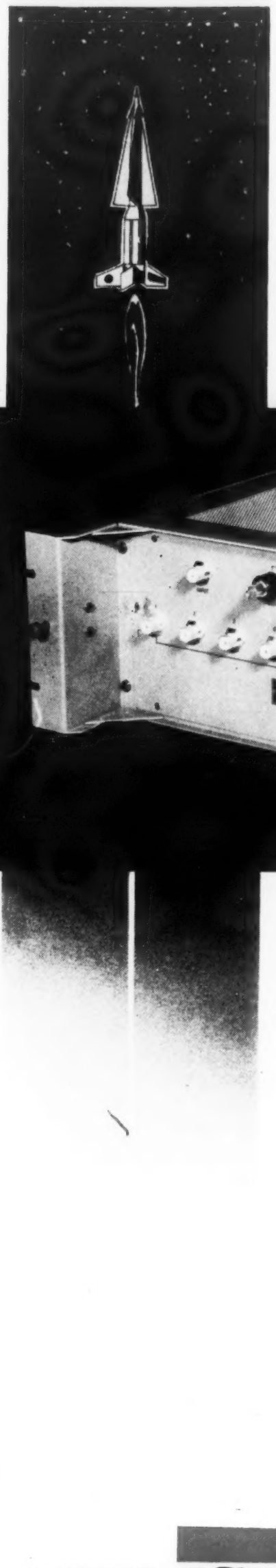
A field trip to the Boston Navy Yard is always looked forward to. We are given the "red carpet" treatment and shown through a capital ship that is in the Yard. The guided missile cruiser *Boston* naturally draws a large turnout, as does the aircraft carrier *Wasp*. The intricacies of a ship and how it is operated is a source of wonder to the cadets, and the communications set-up leaves them speechless. They begin to see in practice the important part communications does play in the defense forces. These tours are made more memorable by the pride and enthusiasm the Ship's Company displays in their ship, and they go "all out" in taking these groups of eager cadets around.

Another field trip which we have for each Division is a drive to Fort Devens, where Army helicopters are explained, after which an orientation flight is taken. This is an experience which makes a vivid impression on the young men and becomes a conversation piece among their friends and also acts as a recruiting agent.

Other field trips have included guided tours through the technical facilities of radio and television stations, newspaper plants, fire alarm headquarters, electronics manufacturing plants, computers, etc. So it can be seen that the interest generates the activity.

What sort of guest speakers do we have? Basically the kind whose subject matter is of interest to the members. We have had everything from

**The author is a former Assistant PMST at Northeastern University.*



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PM-406

PREAMPLIFIER-MULTICOUPLER

THE PM-406 is a combination instrument comprised of a preamplifier and multicoupler located on a single chassis for rack mounting. This unit permits the coupling of eight receivers to a single antenna and is designed for use where short runs of cable from the antenna are employed. These units are of the "bath tub" chassis design having a 3-inch recessed front panel to permit patching cables to hang without protruding. Modifications of this design are available on special order.

SPECIFICATIONS

Pass Band	215-260 megacycles
Uniformity of Response	Within 3db
Gain	22db (approximate)
Impedance	Designed to operate in a 50-ohm system
Inputs	1
Outputs	8
Noise Figure	Less than 4.5db
Isolation between outputs	37db minimum
Size	19" x 7" x 16½"

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PRECISION ELECTRONICS SINCE 1909

erudite lectures by Dr. John S. Rinehart of the Smithsonian Astrophysical Lab, which played such an important part in the IGY activities and the satellite tracking operation, to a talk on Ancient Firearms. Other speakers have dealt with the science of motion picture production, the part the Signal Corps plays in meteorology, the Army Flight Program, or an illustrated travelogue by military members of our Detachment. A broad range of topics is selected in any one term and the amount of audience participation is the yardstick by which a successful meeting is measured.

Some meetings do not have a formal program. Parliamentary procedure is practiced and there is a free interchange of ideas on matters pertinent to the Chapter and the members, e.g. committee reports, etc. We have an annual dinner party as well to bring in the distaff side of the Chapter.

What symbols are there? We are fortunate in that AFCEA puts out a ribbon. These ribbons are worn proudly on the cadet uniforms and add prestige at the Military Ball and such social gatherings. Also there is a great deal of interest and competition for the annual AFCEA medals given to the best man in each class.

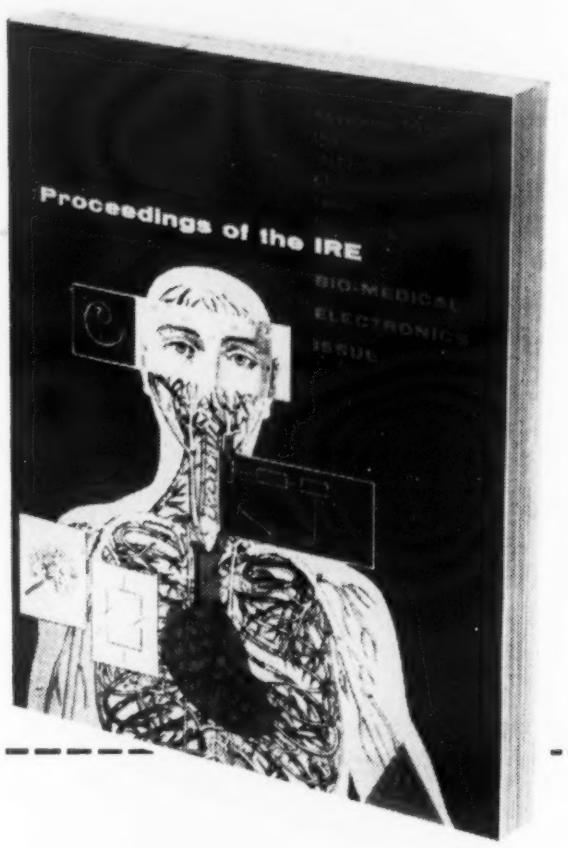
What does a member get out of AFCEA? We think he gets a great deal, and to quote a time worn cliche, "as much as he puts in it." First we stress the opportunity for the student to rub shoulders and share ideas and interests with a cross section of the student body of the University. A freshman engineering student learns from and tends to gain some of the "savoir-faire" of a fourth year journalism major, and a second year business administration student finds out that his contemporary, who is a physics major, does not depend on formulae alone as a mode of expression—he is human too.

Stephen Baranowsky, an electrical engineering senior, the recipient of an annual AFCEA medal, and vice president of Division "B" student chapter, said, "I became acquainted with AFCEA in my sophomore year and I have enjoyed my participation ever since. It has given balance to my school program and has allowed me to exchange ideas with other students at Northeastern and see and do things on field trips that were of great value to me. The student members are affected by the contagious enthusiasm of the military advisors, and the student is made to feel wel-

(*Continued on page* 40)

Here is the fascinating field of

BIO-MEDICAL ELECTRONICS



The purpose of this special November issue of **Proceedings,** as outlined in the guest editorial by J. W. Moore, National Institute of Health, is "to provide its readers with some interesting, informative and perhaps provocative examples of various weddings of electronic art and concepts to some of the life sciences. This collection of articles is not intended to delineate Bio-Medical Electronics, but rather to illustrate the breadth of the field of interest of the Professional Group on Medical Electronics, which, by constitutional definition, is the study of biological and medical systems." Thus begins one of **Proceedings'** most fascinating issues — one that presents the scope of the broad new avenues of experimentation in biological measurements opened up by the speed, versatility and precision of modern electronics. This special issue is not only the current record of the progress in Bio-Medical Electronics, it is fascinating reading for radio-electronics engineers in general.

26 ARTICLES BY LEADERS IN THE BIO-MEDICAL ELECTRONIC FIELD

Below is just a partial listing of the articles this special issue covers. For example, the development of a broadband electrometer is described in the article by Gesteland, Howland, Lettvin and Pitts on "Microelectrodes and Their Use." This issue gives considerable emphasis to basic biological research. And, because the recruitment and training of personnel to work in the bio-medical instrumentation area is probably the most pressing problem to be faced by the PGME, there are supplementary articles in this area. This special November issue of **Proceedings of the IRE** on Bio-Medical Electronics is only **one** of the many services offered members of the IRE. If you are a non-member and wish a copy of this vital link in the record of radio-electronics, return the coupon below, today, to reserve it for yourself or your company.

PARTIAL CONTENTS OF THIS NOVEMBER BIO-MEDICAL ELECTRONICS ISSUE:

"An Analog Computer to Stimulate Systems of Coupled Bimolecular Reactions," by E. F. MacNichol, John Hopkins University

"Electron Transfer in Biological Systems," by B. Chance, University of Pennsylvania

"Alternating Current Spectroscopy of Biological Substances," by H. P. Schwan, University of Pennsylvania

"Comments on Microelectrodes," by R. C. Gesteland, B. Howland & J. Lettvin, Massachusetts Institute of Technology

"Some Functions of Nerve Cells in Terms of an Equivalent Network," by W. H. Freygang, National Institutes of Health

"Electronic Control of Some Active Bioelectric Membranes," by J. W. Moore, National Institutes of Health

"Measurement of Mechanical Properties of Muscle under Servo Control," by M. Lubin, Harvard University

"Scanning Microscopy in Medicine and Biology," by L. E. Flory, RCA Laboratories

"Instrumentation for Automatically Pre-Screening Cytological Smears," by R. C. Bostrom, H. S. Sawyer & W. E. Tolles, Airborne Instruments Laboratory

"A Magnetic Flowmeter for Recording Cardiac Output," by H. W. Shirer, R. B. Shackelford & K. E. Jochim, University of Kansas

"The Use of an Analog Computer for Analysis of Control Mechanisms in the Circulation," by H. R. Warner, Latterday Saints Hospital

"Some Engineering Aspects of Modern Cardiac Research," by D. Baker, R. M. Ellis, D. L. Franklin & R. F. Rushmer, University of Washington

"Stability, Oscillations, and Noise in the Human Pupil Servomechanisms," by L. Stark, Yale University

"What the Frog's Eye Tells the Frog's Brain," by J. Y. Lettvin, H. R. Maturana, W. S. McCullough & W. H. Pitts, Massachusetts Institute of Technology

"Repetitive Analog Computer for Analysis of Sums of Distribution Functions," by F. W. Noble, J. E. Hayes, Jr. & M. Eden, National Heart Institute

"Medical Ultrasonics," by J. F. Herrick, Mayo Clinic; H. P. Schwan & J. M. Reid, University of Pennsylvania

"The Use of Electronic Computers to Aid Medical Diagnosis," by R. S. Ledley & L. B. Lusted, National Academy of Sciences

"New Instrumentation Concepts for Manned Flight," by L. J. Fogel, Convair

"The Origin of the Professional Group on Medical Electronics," by L. H. Montgomery, Vanderbilt Medical School

"Instrumentation in Bio-Medical Research," by P. E. Klopsteg, National Academy of Sciences

"On the Role of the Engineer in Bio-Medical Instrumentation," by J. P. Hervey, Rockefeller Institute

"Medical Electronics Center—Interdisciplinary Coordination," by V. K. Zworykin, Rockefeller Institute

☐ Enclosed is $3.00

☐ Enclosed is company purchase order for the November, 1959, issue on Bio-Medical Electronics.

All IRE members will receive this November issue as usual. Extra copies to members, $1.25 each (only one to a member).

THE INSTITUTE OF RADIO ENGINEERS
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New York 21, New York

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1 East 79th Street, New York 21, New York

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Signalgram (*Continued from page* 22)

DATEX CORP. has developed a missile tracking system which can accurately record dynamic radar data, correlated in time to 0.001 seconds, in a form suitable for direct entry into an IBM-704 Computer, according to company officials. The system employs servo repeater units to drive shaft position encoders for encoding range, azimuth, and elevation.

ZENITH RADIO CORP. announced the availability of a 3-channel stereophonic high-fidelity portable AC phonograph. Complete with Radial Sound dual remote speakers that are removable for locating up to 10 feet from the master cabinet, the instrument provides "full, 3-dimension stereophonic high-fidelity sound no matter where you sit in the room."

RADIO CORPORATION OF AMERICA will construct a new plant at Mountaintop, Pa., to handle expanding work in the transistors and rectifier fields. Work on the 120,000 square foot building will begin immediately and should be completed by late 1960.

LOCKHEED MISSILES AND SPACE DIV. has been awarded the first nuclear research contract granted an industrial laboratory by the physics branch of the Atomic Energy Commission's Division of Research, according to Lockheed. Previously, the AEC had restricted this type of research contract to universities and non-profit laboratories. The AEC grant is for basic studies on the properties of atomic nuclei through an experimental program using the positive ion accelerator at Lockheed.

HALOID XEROX INC. demonstrated what company officials called "the first fully automatic office copying machine to appear on the market to date" at the Office Equipment Manufacturers Exhibit, held recently in Washington, D. C. Called the Xerox 914 Copier, the machine requires no sensitized or treated papers nor does it require any exposure or developing adjustments.

— GENERAL —

A COURSE IN INDUSTRY DEFENSE AND MOBILIZATION will be conducted at the Office of Civil and Defense Mobilization National Operational Headquarters in Battle Creek, Mich., November 16-20. One in a series of Staff College Courses, this course will provide industrial executives and government officials with practical information and training in procedures for protection from nuclear attacks.

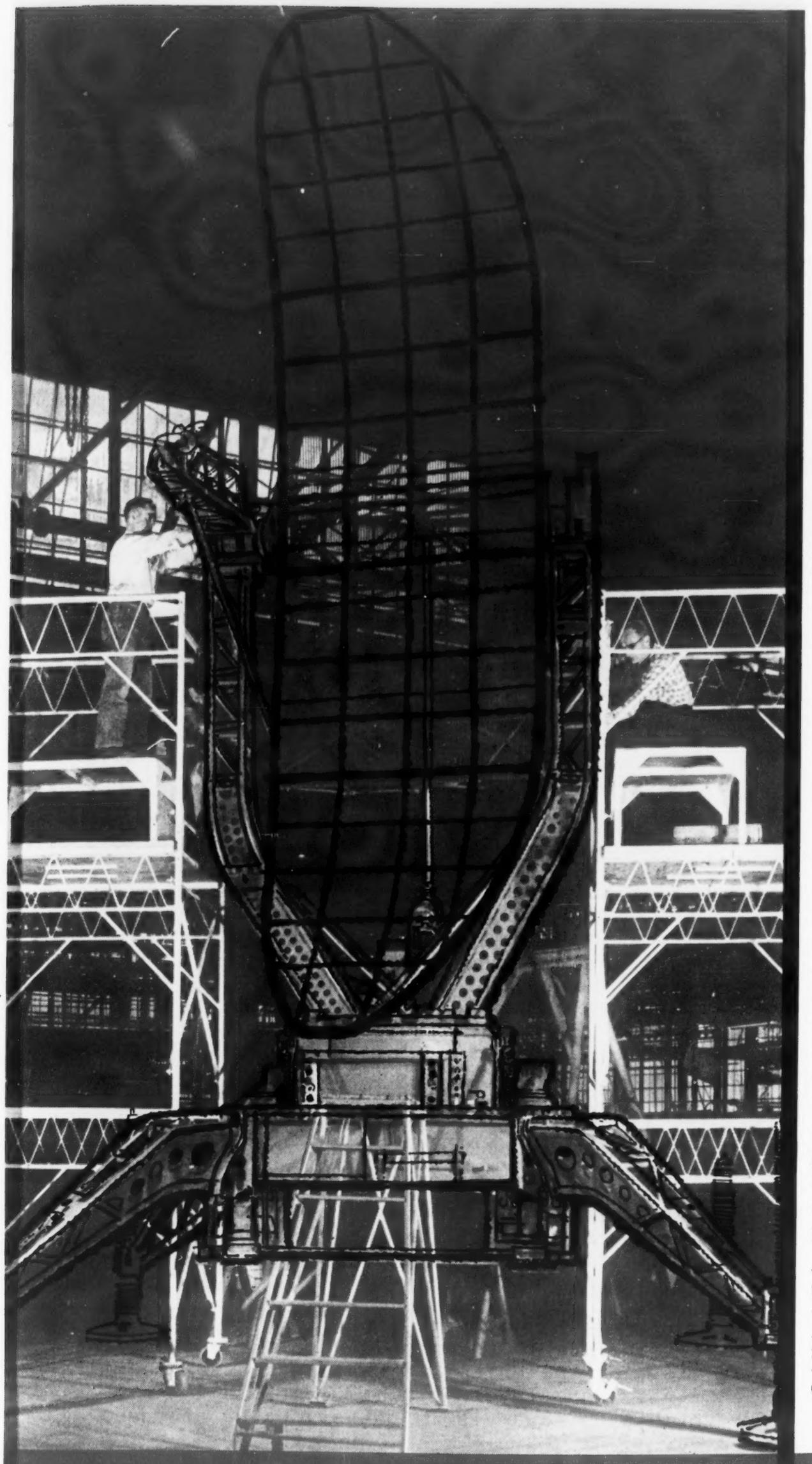
A GUIDED MISSILE FRIGATE named in honor of the late Fleet Admiral William F. Halsey, Jr., is scheduled for construction beginning next month at the Naval Shipyard, San Francisco. The warship, designated DLG-23, is the eighteenth ship in the class of guided missile frigates, which are designated to provide the speed and endurance required to operate with the carrier task force.

FIREPOWER AND FIGHTING EQUIPMENT of "The Army of the Future" were displayed at the all-day meeting of the American Ordnance Association at Aberdeen Proving Ground, Md., October 9. Included in the demonstration of nearly 50 items of new weapons was the first public firing of the Army's new medium assault weapon, ("MAW"). A shoulder-fired, 90mm recoilless rifle capable of destroying the heaviest known tanks, the "MAW" is designed to be carried into battle and employed by two infantry men.

A SUPERSONIC JET RACED WITH THE SOLAR ECLIPSE and obtained a magnetic tape record of polarization of the sun's corona which is expected to contribute significantly to the knowledge of outer space. In cooperation with the Air Force Cambridge Research Center, McDonnell Aircraft Corp. sent a jet F-101B Voodoo at a 45,000 foot altitude over the Canary Islands to obtain the tape recording and to photograph the eclipse, October 2. This is the first time a total eclipse has been directly observed from such an altitude. Previous studies had been made from ground stations.

ROCKET SHIP X-15, which later this year may carry a man to the edge of space, completed two powered flights recently after several unsuccessful attempts had been made to test the plane. Equipped with twin four barrel rocket engines originally developed for the experimental rocket X-1, the stub-winged, 5-foot black X-15 skimmed in for a landing after being cut loose from a B52 at 38,000 feet and ascending to 50,000 feet over Edwards Air Force Base, Calif.

U. S. DATA PROCESSING EXHIBIT describing the historical development and use of high speed computers in information processing is touring French and Belgian universities and will continue to do so until next summer under the auspices of the United States Information Services. Prepared by the National Science Foundation, the exhibit contains an original unit of ENIAC (Electronic Numerical Integrator and Computer), the world's first electronic digital computer and features a library of the foremost texts on computers and data processing. (*Continued on page* 32)



RADAR...
dishes and pedestals
by Avco/ Nashville

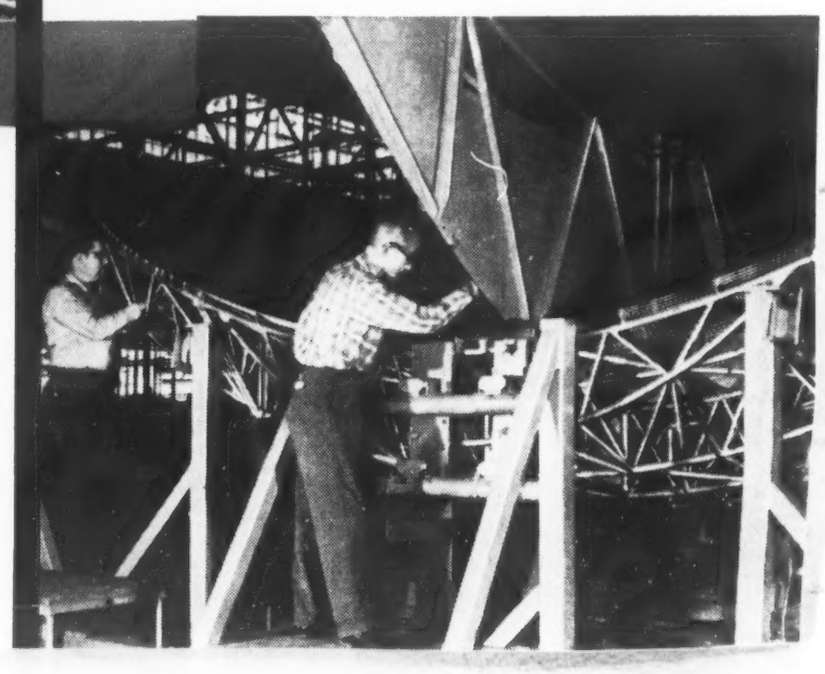
Today, radar takes many forms and handles many different tasks. Construction of a radar unit calls for several specialized design, engineering and production capabilities.

Such specialized capabilities are available at Avco's Nashville Division. At its large plant in Nashville, Tennessee, Avco/Nashville specializes in the design, engineering and construction of radar antennas or dishes. It also offers complete facilities for producing pedestals for large radars.

Recently the MPS-16 radar antennas and pedestals were manufactured by Avco/Nashville. Today, Avco/Nashville is at work on the antenna and pedestal of the FPS-26 radar, researched and developed by Avco's Crosley Division, that will stand three stories high and be housed in a radome about 50 feet in diameter. Also in production: very small radar antennas for use in the Mach 3 military aircraft that will be operating in the early 1960's. These use Avcomb, stainless-steel honeycomb.

Radar antennas of the conventional rod type, glass lay-up, and stainless-steel honeycomb are all within the proven capability of Avco/Nashville's engineering and production facilities.

Avco/Nashville has the capacity as well as the capability for more pedestal and antenna work, and invites inquiries from radar prime contractors. Write to: General Sales Manager, Nashville Division, Avco Corporation, Nashville, Tennessee.



UNUSUAL CAREER OPPORTUNITIES FOR QUALIFIED SCIENTISTS AND ENGINEERS... WRITE AVCO/NASHVILLE TODAY.

Avco / Nashville

Signalgram (*Continued from page* 30)

SOVIET ATOMIC ICEBREAKER "LENIN" sailed on its first cruise recently. Launched at the Admiralty Shipyard in Leningrad, the 44,000 horsepower vessel first was tested in December 1957.

200 HIGH SCHOOL AND COLLEGE SCIENCE TEACHERS noted Signal Corps R&D trends when they attended an all-day meeting recently at the U. S. Army Signal Research and Development Laboratory, Ft. Monmouth, N. J., on "Research and Training with the Army Signal Corps." Sponsored jointly by the Laboratory and the New Jersey Science Teachers Association, the meeting included both demonstrations by key scientists showing research activities in the electronic age and talks by Laboratory engineers.

AUTOMATIC MAP COMPILATION SYSTEM which can give accurate map information from aerial photographs in shorter time than is required by manual photogrammetric methods is being developed by the U. S. Army Engineer Research and Development Laboratories. The output of the system to be completed in 1960 will be ground position information for every point imaged in the photography. The information may be displayed as a contoured photograph in which the position of the image is corrected to its true scale position. The system operates by scanning electronically conjugate points on the overlapping aerial photographs which represent the intersection of a vertical plane with the surface of the earth.

1959 ELECTRONICS PRODUCTION rises to another all-time high, according to a report of the Commerce Department's Business and Defense Services Administration. Factory output of components and equipment in 1959 is expected to hit $8.5 billion, $400 million higher than the 1958 year-end projection, BDSA stated.

AIRBORNE COMPUTER USING INFRARED DETECTION to help it determine aircraft altitude and speed is under development by the Avion Division of ACF Industries, Inc. Built under a study contract from the Air Force, the device "will make a significant contribution to solving the problem of blurred films taken by high-speed photo reconnaissance planes," according to an Avion official.

CALENDAR OF EVENTS:
NOVEMBER 9-15: National Electric Manufacturing Association meeting, Atlantic City.
NOVEMBER 16-20: American Rocket Society meeting, Washington, D.C.
NOVEMBER 16-20: Fifth International Automation Exposition, New York City.
NOVEMBER 18-20: Ninth National Conference on Standards, New York City.
NOVEMBER 29-DECEMBER 4: American Society of Mechanical Engineers meeting, Atlantic City.

— INTERNATIONAL —

BRITISH CABINET MINISTER FOR SCIENCE has been appointed by Prime Minister Harold Macmillan's Conservative Party, which will continue to rule Britain as a result of last month's election. The newly created post is to keep Britain abreast of atomic energy and space research.

AN ITALIAN R&D SUBSIDIARY will be established in Florence by Melpar, Inc., a subsidiary of Westinghouse Air Brake Co. Thomas Meloy, Melpar President, is now in Europe discussing plans for the new subsidiary, which will be called Ricerca Scientifica Applicata. RSA will seek contracts with European and American companies for research and development on a consultant and product-development basis.

A FRENCH SCIENTIST who was responsible for much of the work on the first practical rechargeable silver zinc battery is visiting the United States. Professor Henri Andre, who is a technical consultant to Yardney International Corp., is in this country to confer with American scientists on advances in battery power sources.

FORMATION OF TWO BRITISH FIRMS by United States companies was announced recently. BICC-Burndy Ltd., has been set up by Burndy Corp. of Norwalk, Conn., and British Insulated Callendar's Cables Ltd. of London to manufacture and sell Burndy electrical connectors in the British Commonwealth. U. S. Industries, Inc. (Great Britain) Ltd. has been established by U. S. Industries, Inc. of New York to coordinate European activities of USI's Clearing Division and International Division.

CONSTRUCTION OF A RADAR IN PUERTO RICO has been authorized by the Advanced Research Projects Agency. Equipped with a 1,000 foot diameter spherical antenna, the radar will be used as a means of studying the midcourse effects of atmosphere on ballistic missiles. A tropical site was selected for the installation, which will be completed within two years, in order to observe the planets better.

PART I

INTERCHANGING SCIENTIFIC INFORMATION BY MULTI-LATERAL RADIO COMMUNICATION

by S. EDWIN PILLER, W2KPQ/A2KPQ
Director
First Army MARS SSB Technical Net

IT WAS NOT many years ago that the American public read that the United States Army Signal Corps was discontinuing the use of carrier pigeons because electronics had rendered this method of communication obsolete. At the same time it is interesting to conjecture that had not Hertz, Marconi, Fessenden and others made their epochal experiments around the turn of the century, that the present equivalent of the Military Affiliate Radio System could well have been a group of men whose hobby was raising carrier pigeons instead of amateur radio.

It is an old saying that: "No man lives unto himself." Fundamental is the urge in all mankind to communicate with his fellow man; to share experiences; to exchange ideas; to coordinate the special talents and abilities of groups of human beings into an organized society, that can procure greater advantages for its members than each member could procure for himself. It can, therefore, be concluded that communication is essential to a full life for any individual.

Much of our communications to date has been of a unilateral or one-way nature. We have technical publications, newspapers and broadcasts, to illustrate a few of these types.

On the other hand, the use of multilateral communication has been growing in importance in recent years. There is a tremendous increase in the number of forums, symposia and conventions wherein men with common interests are drawn together to exchange scientific knowledge and experience. Communication has truly been described as the "life blood" of science and technology.

At the same time, the art has advanced to the point where multilateral communication by radio has become of practical value for use in forum discussions. A one kilowatt SSB transmitter, operating on the right frequencies, can cover with a highly reliable skywave transmission, all the area within a radius of one thousand miles or more of a given location. Furthermore, a modern kilowatt SSB station can conveniently fit on a desk top. Of course, multilateral radio communication of the forum type is not limited to SSB. AM and FM are utilized as well.

In going back to some of the history of educational radio, it was quite apparent in the early twenties, when commercial broadcasting was introduced, that the radio medium had tremendous value as an educational device. Many colleges were quick to set up educational radio stations. In the book *Education's Own Stations*, by S. E. Frost, Jr., published in 1937, it states that 202 licenses were granted to educational institutions during the period 1921 to 1936. However, it is important to note that only 38 of these licensees were still in operation on January 1, 1937. The big problem was the financing of these radio stations, since they were non-commercial in nature.

Another notable use of educational broadcasting was that of WRUL, a short wave broadcasting station in the Boston area, which during the period 1935 to 1941, gave lecture courses on the Fundamentals of Radio and Aviation. These broadcasts were financed by a grant from a philanthropic foundation.

With the coming of television in the late 1940's, the FCC recognized the tremendous possibilities of this new medium as an educational force by reserving approximately 250 channels for educational TV stations. Of this number, only some 35 odd channels are being used as of the beginning of 1959. These educational TV stations are being financed by public, philanthropic, industrial and municipal donations.

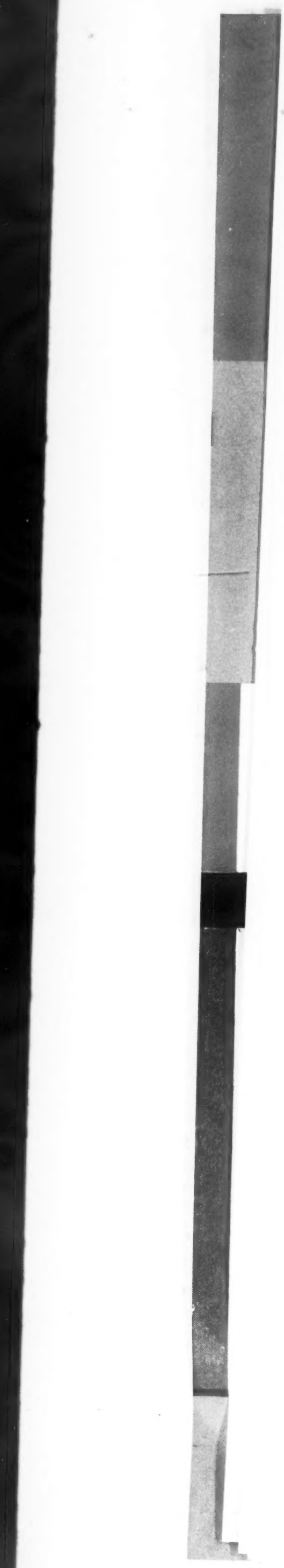
Closed circuit television, of course, is being used in many colleges, schools and military installations for educational purposes. Since its value is obvious, there is no need to dwell on it here.

Teaching Through MARS

On November 5, 1958, the First United States Army MARS in cooperation with the Fort Monmouth Signal Corps School, started a 26-hour course in the "Fundamentals of Electronics." These lectures were given each Wednesday evening at 8 P.M. prevailing New York time. The broadcast was on AM on 4030 kc. and originated from the Fort Monmouth, New Jersey, MARS station. Seven members of the Fort Monmouth Signal Corps School Instructor Staff presented the lesson material.

The January 1959 3rd Army MARS Bulletin stated that Don Wiggons, A4EHU, of the University of Florida, would give a series of lectures by radio on Thursday evenings on the Basic Principles of Radio Teletype Operation. Apparently the educational aspects of radio, both unilateral and multilateral, are taking hold within Army MARS.

Up to now we have been dealing with one-way educational broadcasts. Within recent years the technique of co-channel multilateral communication in connection with technical subjects has increased in popularity. Since this combines advantages of communication and broadcasting, I am proposing a new word to describe this service, namely, "Communicasting." This is obviously a contraction of the words "communication" and



"broadcasting." It can be defined as the use of co-channel, multilateral radio communication to attract a listening audience.

Radio Technical Nets

Let us look into some of the work that is being done in the field of "communicasting."

Radio amateurs for many years have used net operation for informal discussions of technical topics. However, the first organized operation in this field, to my knowledge, was the work which was started and is presently being done by the postgraduate division of the Albany Medical College.

Around the latter part of 1955, two or three members of the faculty of the Albany Medical College discussed a medical topic while in direct radio communication with physicians located in a number of outlying community hospitals. Truly, a two-way radio conference for postgraduate medical education.

For the first two and one-half years the radio facilities involved in the conference network consisted of a high-powered transmitter located at the Albany Medical College, and transmitters of lesser power located in 21 hospitals throughout eastern New York and western Massachusetts. These were operated with the voluntary assistance of more than 70 amateur radio operators who unstintingly donated their time and skills to allow the initial experiment to be developed. Amateur radio wave length transmission was used. A 144 mc. amateur band frequency was employed from 12 Noon to 1 P.M. each day. Gonset communicators were employed in the outlying areas.

Beginning in February 1959, because of important financial assistance from a Rockefeller Foundation grant, an educational FM broadcast station, WAMC, was established. This station now broadcasts on a frequency of 90.7 mc. with a power of ten kilowatts. The main studios, located at the Albany Medical College, as well as each of the 21 outlying hospitals in the network, have a special transmitter which carries signals to Mt. Greylock, Massachusetts, where the main broadcast antenna is located. By these so-called "remote broadcast pickup units," all 21 hospitals in the network can freely receive and transmit questions and discussion regarding the topic of the day. At the same time, any standard home FM receiver within a distance of 75 miles to the west of Albany and 150 miles to the north, east and south of Mt. Greylock, can readily pick up the broadcasts of WAMC.

Amateur frequencies were used for the first two and a half years of this experiment. The individual transmitters at the hospitals were operated by local amateurs using amateur call signs. This apparently was frowned on in some quarters and possibly rightly so.

In a letter of Jan. 22, 1959, the FCC gave the reason why the use of amateur stations for the discussions was discontinued. "Section 12.62 of the Commission's Amateur Radio Service rules, which is titled *Eligibility of Corporations or Organizations to Hold License*, provides that:

'An amateur station license will not be issued to a school, company, corporation, association, or other organization, nor for its use, except that in the case of a bona fide amateur radio organization or society, a station license may be issued to a licensed amateur operator, other than the holder of a Novice Class license, as trustee for such society.'

"The use of the amateur stations for the transmission of these medical discussions for the college was contrary to the eligibility limitations of Section 12.62. Therefore, the licenses of the amateur stations involved were subject to possible revocation under Section 312 (a) (2) of the Communications Act of 1934, as amended. Apparently, the station licensees involved were not aware of the applicability of the limitations of Section 12.62 to the use of their stations."

Spectrum for Physicians

In October, 1958, the American Medical Association petitioned the FCC to adopt certain rule-making proposals concerned with the use of the radio spectrum for communication by physicians. As part of the proposals they want the FCC to amend Parts 3 and 4 of the Rules to permit non-commercial educational FM stations to multiplex broadcast channels and to use such channels and associated remote pickup facilities for educational purposes without restriction. The experience of the WAMC Albany Medical College operation is quoted in the petition. It is stated that the petitioner believes the utilization of non-commercial FM broadcast stations for the continuing post-graduate education of physicians along these lines will expand to where it will be possible to provide a network of educational radio stations over a wide area throughout the United States. The use of these multiplexed channels would make it possible for the educational stations to conduct certain courses of study for a semi-private audience composed of physicians only.

The next technical program of consequence to come into existence was by the United States Air Force MARS. This program started in February 1957 with the organization of the Eastern Technical Net by J. Harvey McCoy, W2IYX, of Huntington, Long Island. This net is open to any Air Force MARS member who resides east of the Mississippi River. It is conducted on AM on a frequency of 7540 kc., with rebroadcasts on 15715 kc. and 3295 kc. Local rebroadcasts in some areas are made on 143.46 mc.

Concurrent with the start of the Eastern Technical Net of the Air Force MARS, the Central Technical Net, under the direction of Major Amos Peters, W5LHX, began operation. This net was designed to cover all the area between the Rocky Mountains and the Mississippi River. Unlike the Eastern Technical Net, which presented speakers from the electronics field followed by question and answer periods, the Central Net at first dwelled mainly on the conversion of surplus electronic gear available to members of the MARS program. Later on this net began rebroadcasting tapes of the Eastern Technical Net, and also presenting speakers of its own.

The Air Force MARS Western Technical Net, directed by John Ellison, W6AOI of Menlo Park, California, came into existence in April 1958. This net covers all of the area west of the Rocky Mountains. It, too, started at first rebroadcasting tapes of the Eastern Technical Net but lately has been presenting a well rounded and well publicized list of its own speakers.

First U. S. Army MARS SSB Technical Net

The first United States Army MARS SSB Technical Net, commenced operation officially on January 6, 1958, with a talk by Raymond F. Guy, W2AK, Senior Staff Engineer of the National Broadcasting Company. His topic was "Little Known Facts About the Broadcast Industry." For several months prior to that, the net had been operating on an informal basis with technical presentations by the members.

At the beginning, the net was opened to all members of the First Army Military Affiliate Radio System who could operate on a single side band. Later on AM stations were invited to participate providing

they could maintain the required frequency stability. The prime mission of this net is the dissemination of technical knowledge by radio communication. The First Army Area includes the First and Second Amateur call areas, which contain the states of New York, New Jersey and all the New England states.

At this time a word of information about Army MARS is in order. Army MARS is essentially a second line of communication for the Army in the event of an emergency. The essence in training has mainly been in traffic and communications techniques. It was not until recently that thought and action have been put into training in the technical realm.

Contrary to what many people think, MARS is not an organization for military reservists, although some do belong. Any licensed radio amateur can participate in MARS activities and may withdraw as he pleases with no strings attached.

Let us now examine the record of the First Army MARS SSB Technical Net. During 1958 the net presented a total of 37 weekly talks with a transmission reliability of 97.5%. One of the talks which was disrupted by an aurora storm was presented at a later date. Telephone patch techniques were used to permit speakers in distant cities to talk to members of the net through the stations of net members living near New York City. Engineers from leading communications companies in Cedar Rapids, Chicago, and Dayton were brought on channel in this manner. Taped talks were also used to good advantage.

The net passed another milestone when on April 8, 1958, Wes Peterson, the engineering manager of Engineering Department No. 4 of the Collins Radio Company of Burbank, California, gave a talk on *Electro-Mechanical Filters*. This talk was presented from a taped recording. Immediately following the talk Mr. Peterson was tied into the net by means of a transcontinental phone patch between Burbank and New York City. This is more than ample demonstration of how the net can reach out for thousands of miles and communicate, for a minimum of cost, with some of the leading specialists of our time. Also let's not forget the educational benefits derived by the listening audience.

The outstanding specialists in the electronics and communications field presented by this net have attracted a large listening audience within a 1000 mile radius of New York City. Letters have been received from engineering students, engineers, radio amateurs and short wave listeners. A letter even arrived from an Air Force man in the Azores, over 2500 miles away, telling of an audience there.

Speakers have originated their talks from the homes of amateurs living near them. Radio amateurs who have presented speakers include George Korper, A1CFE, Woodbridge, Conn.; Howard Wright, Jr., A1PNB, Bristol, Conn.; Fred Dickson, AA2HJU, Fair Haven, New Jersey; John Novak, AA2KUC, Clifton, New Jersey; Al MacDonald, A2PRB, Massepequa, L. I.; AA2USA, the Fort Monmouth MARS Station; Ben Russ, A2QZ, Flushing, L. I., and me, A2KPQ, Whitestone, L. I.

This net operates on the First Army Command Channel of 4030 kc. each Wednesday evening at 9 P.M. (prevailing New York time). The net is in session September through May of each year. It recesses during June, July and August.

The background of the net members varies from supervisory engineers to workers in non-technical fields. Therefore, efforts have been made to keep the talks at medium level with emphasis on the practical rather than the mathematical aspects of the subject.

The net has received good publicity in many leading publications in the electronics and communications field. The following periodicals regularly publish the monthly schedules: *QST*, *CQ*, *Proceedings of the Institute of Radio Engineers*, *SIGNAL Magazine*, *Radio & Television News*, *Electronic News*, *QUA*, *the First Army Mars Newsletter*, and *The Sidebander*, the official publication of the Single Sideband Amateur Radio Association. Other articles about the net have appeared in *Popular Electronics*, *Electronic Industries*, *Electronics* and *Radio-Electronics* magazine.

END OF PART I—PART II in December

Missiles and Space Technology

(*Continued from page* 13)

that while they use their successes effectively for propaganda—and are able to hide their failures—their public claims have been, to the best of our knowledge, factual. Their scientists, however, are not the giants they would have us believe—they simply started working in this particular field six or seven years before we did. It would be tragic if we had to admit they were working harder today than we. But they have set for us some targets by the success of their efforts thus far announced.

For instance, while we have no information which leads us to believe that the Russians have solved all of the guidance problems I mentioned earlier, obviously their guidance is good and obviously they are not standing still.

Requirements for Space Travel Are Many

One of the most sensible men in our business today is my good friend, Dr. Lee DuBridge, President of the California Institute of Technology. I presume that most of you have read his article in the August issue of *Harper's Magazine*. I think he offers the most reasonable analysis of our present situation that I have seen lately.

Dr. DuBridge reminds us that conditions in space are completely outside all human experience up to now. He points out that the essential elements that sustain life—among them air, water, and food, as well as fuel for the craft—are missing. All these things, including instruments and other kinds of equipment, will have to be carried along with the astronaut, creating the biggest problem in logistics that has ever faced an expedition into the unknown.

Dr. DuBridge goes on to say that at the presently attainable rate of 93,000 miles per hour—the speed required to overcome the gravitational attraction of the Sun—it would take three weeks to arrive at Mars, more than three years to visit Neptune, and 28,000 years to reach Alpha Centauri, the nearest star.

He emphasizes that maneuvering in space calls for totally new techniques of motion. No object in orbit can overtake another one, or lie in wait for it. Instead, it must be intercepted by a trajectory based on complex calculations, and on adjustments in course and speed of the utmost exactness.

The energy requirements for space vehicles are most formidable, and Dr. DuBridge cites the problem of sending a single man with a minimum amount of equipment (weighing in all about 1 ton) on a trip to the Moon and back. A rocket with about 300,000 pounds of thrust—and we have such rockets—will carry him to the vicinity of the Moon. But the weight of fuel needed to land him on its surface will treble the necessary thrust, raising it

to 900,000 pounds. To bring him back and land him safely on the Earth increases this to at least 5,000,000 pounds of thrust—several times the amount provided by the biggest single rocket engine now under development by NASA.

In spite of these difficulties, and others equally challenging to engineers and physiologists, Dr. DuBridge is not discouraged; nor am I. We share the belief that space exploration by mankind within the Solar System is both feasible and necessary—that it is indeed inevitable—and that it may offer rewards enough, in knowledge and in practical benefits yet unknown, to keep humanity occupied for the next hundred years. We recognize that the total cost will be colossal, but that the unforeseen—and unforeseeable—dividends, spread out over the years, will justify the cost.

Some Americans, as I and no doubt many of you have learned, have quite a different outlook. The other morning I had breakfast in the coffee shop of a Washington hotel. Two men were at an adjoining table. One was in a table-banging temper. When he mentioned what he called "this space folderol," I naturally pricked up my ears. I confess that I eavesdropped a little, which wasn't hard since he had a powerful voice and made no attempt to lower it.

Among other things, he said—and I quote—"We had a three-inch rain in Washington last Saturday. So what happened? The drains need working over so badly that a good deal of the city was flooded. People had to swim away from their cars.

"Now," he went on to say, "with a situation like that, right here in Washington, why in the name of common sense are so many millions being spent on such nonsense as shooting a lot of hardware to the Moon? Who cares about the Moon? There's plenty to do down here without wasting money on things like that."

There is, of course, a fundamental difference between solving the problem of overloaded storm drains and sewers in Washington and conducting research and development in space. For the drainage problem there is a ready solution needing only money to complete the loop. Research in space and the development of useful applications of knowledge gained through that research requires imagination, courage and lots of money. It may well prove to be one of the most exciting and profitable ventures of all time. But it is so easy to be carried away by our own enthusiasms to the point where we begin to ignore realities.

Naturally, I do not agree with the gentleman's opinion about this matter. I do, however, concede that he had a right to his opinion and I am afraid that there are many others like him—persons who are less than excited over trips to the Moon and the building of way stations in space. Our problem is to be as responsible as possible in our public utterances in this field. Overstatements of wonders that are to come may be exciting to some people—but I seriously doubt that those on whose understanding we must depend for continuing support will be thus convinced.

Speaking of support—you will note that I have said nothing directly about costs. That is a story in itself with which most of you have some familiarity. I would say only that space program costs will increase substantially in the years ahead if we are permitted to carry out the programs now believed to be desirable and necessary in both the civilian and military fields.

If you term this a sobering picture, I have made my point. But I do not intend it to be a pessimistic one. Our horizons will be bounded only by the limits of our imaginations, our ability to perform responsibly the tasks we undertake and by our ability thus to convince the Congress and the public of the worth and urgency of our programs. It is high adventure we are experiencing—let us be worthy of our trust.

A New Era in Combat Surveillance

(*Continued from page* 20)

is at least seven times the power used previously in combat surveillance radar sets.

Recognizing the importance of this vital field, our engineers are currently striving for further improvements in combat surveillance radars.

Because of its accuracy, sensitivity and other characteristics, the TPS-25 may have applications over and above its usefulness as a combat surveillance radar. Its ability to accurately distinguish among and pinpoint movements at long range suggests that it can perform sentry duty in areas other than battlefield front lines. Our engineers are currently exploring these possibilities.

By familiarizing Hazeltine with its needs and guiding the design and development work, the Signal Corps has been a valuable partner in this program. The close cooperation between the Army and Hazeltine enabled our Electronics Division to appreciate the needs of the Army and familiarized the Signal Corps with the technical capability which could be produced. We earnestly believe that it is this kind of teamwork which will continue to create superior equipment and systems to keep our defense strong and to advance the art in the ever-changing electronics field.

Remarks by Brig. Gen. Thames at the Press Conference-Demonstration of AN/TPS-25

The AN/TPS-25 answers an important combat need for long range ground radar surveillance. With it, we can now spot moving targets 20,000 meters or about 21,000 yards away in all weather, night and day, and distinguish one target from another.

To understand better where it fits into the combat surveillance picture, this equipment is one of a family of three ground radars currently under development. There is the short range ground radar which has a range capability of 5,000 meters against moving targets and the medium range radar with a range capability of 10,000 meters against moving objects. This equipment, then, is the long range surveillance radar for moving targets out to 20,000 meters.

Despite its range and capabilities it is a mobile equipment which can be moved overland or by helicopter. It has undergone extensive tests and the results have been rewarding. The ultra-sensitivity of this radar permits us to differentiate by sound between a man and a wheeled vehicle and a tracked vehicle. At 10,000 meters we can tell if a man is running toward us or crawling. We have been able to distinguish between a squad of soldiers and an individual soldier approaching the set from 1,000 meters away. When teamed with infantry and artillery, this radar will be able to alert commands and provide for targets 24 hours a day under all weather conditions. To give you an idea of the exceptional capability of this radar, on one test, under ideal conditions, a soldier walking was spotted 15 miles away.

*

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EXCELLENCE IN ELECTRONICS

MAN'S DREAM OF CONTROLLING THE WEATHER

(Important facts about one of our most important resources)

by
Anthony Kurtz and Sp4 Dwight Terry

Instructors, Dept. of Specialist Training
U. S. Army Signal School, Fort Monmouth, N. J.

THE CHALLENGE THAT NATURE presents to man has been one of monumental proportions throughout the ages. Mother Nature jealously guards her secrets as man searches for new techniques to discover them.

One of the most complex and "fog-shrouded" puzzles is that of the weather. Man speaks of someday controlling the weather; yet, even today the science of meteorology does not have a universally accepted coherent picture of the mechanics of the atmosphere. This is due in part to our inadequate tools for theoretical analysis of the Earth's moving atmosphere.

The foregoing certainly presents a frustrating obstacle; however, meteorologists now aided by the electronic and rockets engineers doggedly go forward. Meteorological instrumentation has been improved through various electronic devices. With the development of the rocket program, man has entered the space age. Although in its infancy, it will soon allow him to measure atmospheric parameters heretofore unattainable. With the increased emphasis placed on meteorology we may consider it leaving its dark ages and entering a new Golden Era. Much hard work, however, is still to be done. In this article we shall discuss the evaporation process and the problems man faces in controlling this variable.

One of the most important constituents of our atmosphere is water vapor. Water is essential to the nourishment of crops, for the growth of forests, for the processing of industrial products and for the creation of hydroelectric power. Without this ever-flowing source of "liquid gold" the progress of this country in agriculture, industry, and commerce would never have occurred. Many of us take the supply of this precious liquid for granted even though the demand for the use of increasingly large amounts of water continues. In order to illustrate the vast quantities used, we may look at three industries for an example.

It has been estimated that in order to refine one gallon of gasoline, twenty-three gallons of water must be consumed. The rubber industry estimates that one hundred and sixty gallons of water are needed to produce one pound of butadiene. Figures from the steel industry show that thirty-six gallons of water are required to produce one pound of steel.

Water vapor exists in the atmosphere in variable amounts from one tenth of one percent to four percent. Figuratively speaking, this amount seems inconsequential; however, it has been estimated that if a rain shower occurred simultaneously over the earth, one inch of rain would cover this planet. To increase available water sources we would have to reduce all our losses by evaporation and transpiration. Thus, it can be concluded that if we wish to control the evaporation processes we would have to perfect chemicals to bring about this change.

Water vapor enters our atmosphere by evaporation of minute liquid particles from oceans, lakes, rivers, etc. The triggering effect is heat which causes the liquid to pass into water vapor. The vapor remains in this state until it is forced to rise and cooling occurs. Eventually the parcel of air containing this invisible gas reaches its dew point temperature. The dew point is the temperature to which air must be cooled, under constant pressure, in order for condensation to occur. When this takes place, the water vapor condenses into visible water and is seen as a cloud. The supply of water vapor for the production of rainfall largely determines the ability of a region to support life.

Another factor of great significance is the ability of water to absorb certain types of radiation. The sun transmits heat energy to the earth. This type of radiation is known as short-wave radiation, and is similar to radio waves and X-rays. The water vapor in our atmosphere is of a changeable nature; thus it will not accept short-wave radiation. In other words, it allows these waves to pass through. When this energy reaches

(Continued on next page)

The Northeastern Story

(Continued from page 28)

come and proud to be part of such an organization."

It can be said that the students do gain something from their association with their four Chapter advisors, who represent many years of different types of military service in different parts of the world.

Another benefit the member receives is the opportunity through field trips, lectures and perusal of SIGNAL to become more aware of the business world than his age would indicate. In some cases, by attendance at the Boston Chapter meetings, the student may come to the attention of someone who will hire him while he is in college or when he graduates. He begins to realize that our society and economy is based on "contacts." The more favorable ones he can establish, the better it will be for him.

What happens to him afterwards? In most cases, he continues his affiliation with AFCEA during his obligated military tour and then joins the AFCEA Chapter near his place of employment. Some graduates have been kind enough to stop back by the University and talk to the members about their Army experiences and the part AFCEA played.

The Chapter is fortunate in that the Chief Signal Officer has seen to it that a representative number of the members are in attendance at the annual AFCEA Convention each year. The value each cadet receives from the experience is hard to estimate. All have been lavish in their praise of the treatment they have received and the insight they were able to get into the workings of big business in co-operative competition.

Are student chapters feasible? Yes, but they require a special climate to flourish. We are fortunate at Northeastern in that the climate appears to be about right for the cultivation and harvesting of the fruits of a student chapter.

Correction

Two equations appearing in the article, *Vehicle-to-Vehicle Ground-Wave Propagation Characteristics* which was featured in the October issue of SIGNAL were printed incorrectly.

The equation on Page 32, second column, paragraph 2, line 5 should read $\sigma_{\bar{x}} = \sigma_x n^{-\frac{1}{2}}$. The equation in paragraph 3, line 13 of the same column should similarly read $\sigma_{\bar{x}} = 7.7db$.

Man's Dream

the earth, the wave length changes and is sent back into the atmosphere as long wave radiation. The water vapor finds this type palatable, and a good portion of the heat being sent back to the atmosphere is trapped in the lower layers. This process is known as the "greenhouse effect." Incoming solar radiation is allowed to enter open space, but a certain portion is trapped by water vapor in the atmosphere. This maintains a temperature balance which makes life on earth possible as we know it. Also, daily temperature changes would be much greater were it not for this invisible gas.

If man were able to control the evaporation process, even partially, a major breakthrough in weather control would be achieved.

One device that man has used to increase the moisture content of air is the water shed. The purpose of a water shed is to retard run-off of ground water back to the oceans. The idea is that trees and vegetation tend to hold moisture in the ground. This moisture will eventually enter the atmosphere by evaporation. Therefore, the chance of precipitation is increased when man uses this device. Water sheds provide the atmosphere with additional moisture. It has been estimated that a single large tree may evaporate into the atmosphere three thousand gallons of water in a single day. This technique cannot be considered as controlling the weather, but it is a good example of man's utilization of nature on a local scale.

Let us now delve into the large scale patterns. In what way can man influence this process? Chemical agents may hold the answer. Chemicals are in the process of being developed that can retard or increase the rate of evaporation. An increase or decrease in evaporation means a corresponding increase or decrease in the water vapor content of the air. There are many chemicals that may be used to control evaporation. The chosen chemical agent must be carefully selected and tested over a long period of time. Some are deadly poisons, others are too expensive or too difficult to manufacture.

Another determining factor is agreement among the nations on the widespread use of these chemicals since the process of controlling the water vapor cycle in any one area could have world-wide effects. For example, Mexico could protest their use in the Gulf of Mexico by saying that increased precipitation would be undesirable at this time. Moscow could conceivably accuse us of cold war tactics by saying that we are using these chemicals as tactical weapons to increase or decrease precipitation in the Soviet Union. International agreement would be necessary before control of evaporation on a large scale could be possible.

In the United States those regions south of the Great Lakes could be among the first to benefit from controlling the weather. In the winter the Polar Continental Air Mass, which is formed in Canada, is relatively dry; however, as it moves over the Great Lakes area, moisture is added by means of evaporation. An example of this would be the snow condition which invaded Oswego, New York last winter. If we could retard evaporation over the Great Lakes, naturally the amount of moisture picked up by the continental polar air as it travels over the lakes would be lessened considerably; consequently, although the snow process cannot be stopped altogether, it can be seen that a reduction in the amount of snowfall would be achieved.

The above is an example of how the evaporation process may be partially controlled through the use of chemicals. However, the problem is one of greater magnitude. If we use chemicals to achieve these results, what effect would it have in increasing or decreasing the stability of our atmosphere? How would their use affect the temperature balance? By decreasing the evaporation process we also stand to lose a greater than average amount of heat trapped by the water vapor in the atmosphere. Thus, it is possible that a cooling trend for soil temperatures would occur. Cooling makes the air more dense and increases the pressure exerted by the air. Consequently, we can presuppose that our high pressure areas would persist for a longer period of time than normally. Thus we could "manufacture" relatively cold, dry winters.

Looking at this from a military standpoint, advances in weather control would certainly cause a drastic change in military tactics and strategy. If rain could be induced under a wide range of climatic conditions, and the control of precipitation could be in our hands, a tool of great offensive and defensive capabilities would be ours. The country that can trigger these changes would undoubtedly possess a weapon more powerful than a gross of hydrogen bombs with no disastrous fallout to contend with.

Controlling the forces of nature is without a doubt man's greatest challenge. Can he force changes to occur in the fluid motion in our atmosphere? With the advent of the rocket age many meteorologists look high into the heavens for answers to these questions. Yet there are those who feel that the answers remain locked within the breast of the Earth and within its initial atmospheric covering called the troposphere.

Can man achieve this goal? Time coupled with perseverance and hard work will answer this question. In all probability this will not occur in the twentieth century, but perhaps this wondrous thing called weather control may blossom midway in the twenty-first century and man's dream of controlling the weather will be fulfilled.

A TRIBUTE TO JACK WORMCKE

by T. E. Gooteé

CLIMAXING A LONG and colorful career as civilian cameraman with the Signal Corps, John H. "Jack" Wormcke retired recently after more than *forty years* of Army photographic service.

"A dedicated employee," commended the Hon. Wilber M. Brucker, Secretary of the Army. "Jack was always on hand, with his camera, at every important Army event or ceremony."

Until his retirement, Jack was a key member of the U. S. Army Photographic Agency in Washington. During his career, he estimates he has taken more than 250,000 feet of motion picture film. In the last ten years, he has taken over 25,000 still photographs and has photographed more top Army officials and covered more major events in Washington than any other photographer.

Born in New York City in 1894, Jack Wormcke first joined the new movie industry as a cameraman at Fort Lee, New Jersey. He worked at the old Eclair and Universal lots with such early silent picture stars as Rudolph Valentino, Hoot Gibson, Mary Pickford, Douglas Fairbanks, and others of that era.

After serving in World War I as first sergeant of a Signal Corps photographic unit, Jack joined the Signal Corps as a civilian photographer in April of 1919.

The veteran photographer has a high regard for the new cameras and speedier film of today. "But the key to good photography," says Jack, "is still the man behind the camera."

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The President, the immediate Past President, the Vice Presidents and the Counsel are ex-officio members of the Board of Directors.
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Association affairs

New Group Member

Standard Electronics Company, a manufacturing firm located in Chicago, Ill., is a new group member of AFCEA.

Company representatives are: C. L. Scheirman, President; R. Van Cleve, Sales Manager; A. Aronson, Director of Engineering; E. Skocypec, Factory Manager.

Association Officials Assist Chapters

A program whereby the National Directors, Regional Vice Presidents and Chapter Presidents will assist National Headquarters in chapter work was discussed favorably at the Directors Meeting September 17, 1959.

National Directors and Regional Vice Presidents will visit various chapters, whenever their schedules permit. The purpose of these visits will be to render assistance and provide guidance in order to promote chapter progress. They also will offer suggestions to National Headquarters for possible speakers for chapter meetings.

To assist National Headquarters in its program for membership renewals, the Regional Vice Presidents and Chapter Presidents are being sent monthly strip lists indicating the names of members whose membership in the Association is about to expire. This procedure will enable the chapter to contact each member on the strip list in order to ensure his continued membership without interruption.

Four New Chapters Under Consideration

The establishment of four new chapters is under consideration at National Headquarters. The chapters would be located at Patrick Air Force Base, Florida; White Sands Proving Grounds, New Mexico; Syracuse, New York and Mexico City, Mexico.

For a chapter to be formed it is necessary, among other things, that there be at least fifteen AFCEA members in that area, three of whom must be United States citizens. After these members petition the Association and all necessary criteria are satisfied, and their application is acted upon favorably, National Headquarters issues a charter to the newly organized chapter.

Presently, there are forty-seven chapters located in twenty-five states, the District of Columbia and nine foreign countries. Chartered last May, the most recent chapter to be affiliated with the Association is located at Santa Barbara, California.

Chapters to Present Company Certificates

A new policy recently adopted by the Association for presenting sustaining and group member certificates to companies was put into practice by the New York Chapter at their September 30th meeting.

In order to give proper recognition to new sustaining and group members who are located in a particular area the Association has asked the chapter president to represent National Headquarters and present the certificate to the company concerned at a chapter meeting. This policy will give the chapter members and the company representatives an opportunity to become acquainted immediately.

The New York Chapter is the first chapter to follow this policy. Henry Bang, president of the chapter, presented certificates to two sustaining member companies and six group member companies at the chapter meeting. International Telephone and Telegraph Corporation and New York Telephone Company are the sustaining member companies in the New York area.

The group member companies include Adler Electronics, Inc.; William C. Copp & Associates; Instruments for Industry; Servo Corporation of America; Telectro Industries Corp. and Teleprinter Corporation.

A seventh group member company, Radio Frequency Laboratories, Inc., received a certificate a few weeks later.

Five other chapters are making plans to present sustaining and group member certificates to companies within their areas. Chicago will give a sustaining member certificate to Cook Electric Company. Cook Electric was the first company to become a sustaining member of AFCEA.

The other chapters and the companies to whom they will present group member certificates include: Detroit-Scanner Corporation of America, Inc., Fort Monmouth-Radio Corporation of America, Astro-Electronic Products Division; Philadelphia-McCoy Electronics Company; Southern California-Ling-Altec Electronics, Inc.

Honorary Member

Honorary membership in the Association is being extended to Admiral of the Fleet, the Earl Mountbatten of Burma, K.G., P.C., D.S.O., in recognition of his appointment as Chief of the Defense Staff of the Ministry of Defense, Great Britain.

As it was upon recommendation of the London Chapter that the honorary membership be granted, the honor will be bestowed at a future meeting of the London Chapter.

NEW MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of September. Members are listed under the Chapter with which they are affiliated.

Arizona

Capt. William F. Barton
Lt. Col. John C. McIntyre
Robert Angell

Atlanta

Henry J. McKinley, Jr.
Capt. Albert G. Redfern
El C. Hall
A. Warren Pledger
Jeff D. Johnson
George E. Mulliniks
Vernon B. Maum
Frank C. Helms

Augusta-Fort Gordon

Lt. Col. Howard A. Gorman
1st Lt. Gerald E. Lyons
Russell B. Karr
Carson D. Whitten, Jr.
1st Sgt. James R. Fultz
Maj. Alfred F. Hart
M-Sgt. Norman A. Hilbert
M-Sgt. Robert K. Moore
Capt. Fred N. Shroyer
Sgt. Louis R. Navarro

Baltimore

John N. Johnson
Neil W. Beckman
Herman H. Jones
Raymond P. Moore, Jr.

Boston

J. J. Bagnall
R. Kilham
R. Sproul
W. Mainberger
G. R. Loux
W. Marcus
S. Fast
C. Peterson
J. Conway
P. Smith
J. Hannigan
T. D. Walsh
S. W. Bateman
H. D. Guy
A. McCoubrey
Fred Schaper
Cdr. Floyd J. Greene
Lt. Col. William W. Eakins
1st Lt. Robert C. Beatty
Lt. Col. Arthur E. Cotter
George O. Greenwood
Capt. Roy M. Rich
Capt. Leonard M. Havens
Capt. George A. Nigro
Capt. Oscar R. Giordano
Capt. Norman A. Spiro
CWO-2 Joseph J. Jellinek

Chicago

Harry E. Allen
Capt. James R. Montoya
Clifford Pike
L. A. Kruncl
D. A. Potter
W. J. Rieger
R. C. Salsini
E. W. Stipek
Stuart L. Dunkle
Richard Schulz
Louis Sirt
Carroll W. Hoshour
CWO William J. Cathbertson
Neville H. Bennett
E. A. Carter
E. Louis Haan

Dayton-Wright

Col. Robert L. Salzarulo
Richard E. Houser
H. H. Moyer

Decatur

Richard L. Coombe
Robert M. Austin
James L. Swinger
Harold E. Clanton
Jerry L. Yost
Gary D. Hott
Jack R. Bentley
John W. Zuttermeister

Detroit

Capt. Hamilton F. Smith

Fort Monmouth

Lt. Col. Herbert S. Bennett
Frank A. Brano
Herman B. Abrams
Richard W. Hines
Anthony J. Durstewitz
Col. Irving R. Obenchain, Jr.
Howard H. Falk
Robert G. Forrester
Christopher N. Blagdan
Zane W. Herrholz
Ed Whalen

Gulf Coast

M-Sgt. Walter E. Lessard
Frances L. Morrow
Dennis L. Jordan
Clyde B. Meece
Dovel Boles
Alta V. Zimmerman
SM-Sgt. Richard O. Gettys
T-Sgt. Roger W. Fleury
Ruby E. Howery
S-Sgt. Otho N. Gronk
Francis A. Taylor
M-Sgt. William A. Haas
Edward L. Moore
Capt. Harold A. Blough
A-1C Kenneth M. Ezzell
Lt. Alfred W. Clark
Vernon O. Slayter
Lt. Col. Ernest O. Bonham
Howard D. Yund
Robert L. Shutt
Lt. Col. George S. Walborn
Billy B. Moss
Hubert D. Vance
M-Sgt. Marvin G. Meek

Hawaii

Benjamin Kauahikaua
Fred H. Murai
W-1 Guy M. Youngberg
RMC Lincoln D. Nave
Raymond C. Hill
Richard Oberdorfer
T-Sgt. Harry E. Woodward
Margaret V. Tougher
Richard H. Goodwin

Kansas City

Maj. Richard H. Marsh
Maj. Elbridge B. Ousley
Virgil H. Meyer
Rudolph M. Larez
Maj. James T. Walker
Maj. William H. Bowen
Capt. Robert R. Johnson
Erna D. Jackson
Harley D. Williams
Jean M. Happer
Joyce M. Faller
Capt. Harold G. Henry
John Herdt
Paul H. Henson
Ralph Lucier

Lexington

Arthur F. Boyd

Louisiana

Cdr. Harry H. Hudson
Rev. Homer R. Jolley
John R. DeSilva

Montgomery

Capt. Samuel T. Cooper

New York

Lt. Col. Elliott C. Cutler, Jr.
Maj. Herbert A. Schulke, Jr.
Capt. Charles P. Alter
Richard H. Herdman
E. M. Brown
Leonard Goldman
Edward M. Giba
Otto Richter
Ben Steiger
Carl Anderson
Leo G. Sands
Raymond F. Kelley
Zambry P. Giddens
Michael B. Kraus
Donald F. Koijane
Vincent T. Kenney
Theodore Andrzejewski
Arthur L. Anderson
Walter A. Cobb

North Carolina

Harold N. Simpson
Capt. William R. Cash
Richard B. Cashwell
Col. David T. Griffin

Northwest Florida

Jack E. England
Lt. Vincent R. Hohman
Francis W. Taylor

Orange

Howard F. Blackwood

Paris

Jean P. Millet
Roger H. Gilardi
Lt. Robert P. Wathen
Lt. Col. William T. Riley, Jr.

Philadelphia

Eleanor J. Ciccotello
Esther P. Housley
Margaret C. Mendoza
Reva H. Fanning
Dorothy C. Edwards
Florence B. Fireman
William J. Flynn
Dellvon K. Fall
Lillian A. Lesser
William J. Bailey
Christopher Chanako
Arthur B. Gittelman
Carleton R. Iseminger
George S. Kennings
George T. Kourides
Melvin K. Lucas
Edward A. Mason
Matthew E. Osiecki
Henry Reingold
Arthur L. Rowland
George H. Simon, Jr.
Philip J. Smith
Robert M. Tomar
Anthony V. Welsh
Harry A. Stuart
Joseph S. Alleyne
Edward C. Burnshaw
Vincent N. Burroughs.
Austin G. Christiansen
George J. Ferry
Irving Azoff
Nathan S. Goldstein
William C. Herle
Paul T. Leibovitz
James E. Lynch
Ruth Mack
Frank J. McAdams
Thomas F. McGurk
Howard W. Miller, Jr.
Berenice A. Bradley
Frederick S. Minassian
Howard E. Moore
Harold P. Ormsby
Ottavio T. Di Renzo
George Shechtman
Arthur Wellman
Lt. Col. Herman O. Voigt
Martin Good
James M. Marsh
Joseph E. Donnelly
Walter H. White
Hershey Silverman
Samuel Rabinowitz
Robert A. Sinclair
Ruth K. Yeager
John R. Flynn
Francis E. LeMay
Frank J. DePalma
Sidney Turk
Moe Levine
Donald G. Buscher
Col. Rolla D. Pollock
William J. Feeney
Warren D. Leonard
Lt. Col. John J. S. Doyle
Herman Platt
2nd Lt. Frederick E. Barmore, Jr.
James E. Van Horn

Philippine

Henry M. Buhrman

Rocky Mountain

Donald G. Chapman
Richard C. Kirby
Charles L. Rider
Bud T. Cahoon
Capt. Everett S. Turner

Rome (Italy)

Dr. Fausto Alcaro
Dr. Giovanni Soleri
Dr. Gustavo Savini

(*Continued on page* 64)

AFCEA Sustaining and Group Members

Communications—Electronics—Photography

Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security.

Sustaining Members

Cook Electric Co. • International Telephone & Telegraph Corp. • New York Telephone Co.

Acme-Danneman Co., Inc.
Adler Electronics, Inc.
Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Amphenol/Borg Electronics Corp.
Anaconda Wire & Cable Co.
Andrew Corp.
Arnold Engineering Co.
Atlas Film Corp.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Beiser Aviation Corp.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Convair, Division of General Dynamics Corp.
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Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Designers For Industry, Inc.
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
Du Mont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
General Analysis Corp.
General Aniline & Film Corp.
General Communication Co.
General Electric Co.
General Electric Co., Defense Systems Dept.
General Telephone & Electronics Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Laboratories, Inc.
William F. Hogan Associates, Inc.
Hughes Aircraft Co.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
Instruments for Industry, Inc.
International Business Machines
International Resistance Co.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Jerrold Electronics Corp.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Leich Sales Corp.
Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Ling-Altec Electronics, Inc.
Litton Industries, Inc.
Lockheed Aircraft Corporation
Machlett Laboratories, Inc.
Magnavox Co.
Marconi's Wireless Telegraph Co. Ltd.
Materiel Telephonique Co.
McCoy Electronics Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co., Rola & Jensen Divisions
National Co., Inc.
Nems-Clarke Co., Div. of Vitro Corp. of America
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Electronics Corp.
Page Communications Engineers, Inc.
Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
Plessey Co., Ltd.
Prodelin Inc.
Radiation, Inc.
Radio Corporation of America
Radio Corporation of America, Astro-Electronic Products Div.
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
Radio Frequency Laboratories, Inc.
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Saxonburg Ceramics, Inc.
Scanner Corporation of America, Inc.
Servo Corporation of America
Singer Manufacturing Co., The Military Products Division
Smith-Corona Marchant Inc., Research and Development Division
Society of Motion Picture & Television Engineers
SoundScriber Corp., The
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
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Sprague Electric Co.
Stackpole Carbon Co.
Standard Electronics Co.
Standard Telephones & Cables, Ltd.
Stanford Research Institute
Stewart-Warner Corp.
Stoddart Aircraft Radio Co.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
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Technical Materiel Corp., The
Telectro Industries Corp.
Tele-Dynamics, Inc.
Telephonics Corp.
Teleprinter Corp.
Teletype Corp.
Texas Instruments, Incorporated
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Chapter News

Atlanta

The first meeting of the 1959-60 season was held on September 22nd at the Officers' Club, Fort McPherson. There were 226 members and guests present, including some visitors from nearby Fort Benning and Fort Gordon. A social hour preceded the dinner-meeting.

Highlight of the evening was an informal talk by Maj. Gen. R. T. Nelson, Chief Signal Officer of the Army. He was introduced by Col. Kirk Buchak, Signal Officer, Third Army.

General Nelson's subject was "Signal Corps Firsts." He told of continuing efforts to develop new and faster media of communications to keep pace with the missile age, and spoke encouragingly of possible future use of satellites as relay stations. He prefaced his talk with a brief discussion of the history and aims of the AFCEA.

An AFCEA lapel pin was presented to William B. Bryan in recognition of the fine job he did as president of the chapter in 1958-59. The presentation was made by President A. E. Arnold.

The new officers, directors and committee chairmen for the new year were installed as follows: president—A. E. Arnold, Western Union; vice presidents—Henry J. McKinley, Georgia Tech.; Lt. Col. Thomas A. Pugh, Third Army; Lt. Col. Luther J. Ross, Atlanta General Depot; G. M. Sweeney, Southern Bell; secretary-treasurer—A. M. Wilson, Southern Bell; directors—E. O. Betscher, American District Telegraph Co.; W. B. Bryan, Southern Bell; Col. Kirk Buchak, Third Army; A. J. Cartey, Southern Bell; Capt. Jesse Draper, USN(Ret.), Draper Owens Co.; C. M. Eberhart, Southern Bell; Gerald H. Ghertner, Collum & Ghertner Printing Co.; Ben S. Gilmer, Southern Bell; W. L. Mollands, Stromberg Carlson Co.; G. E. Mulliniks, Western Union; John E. Ramsey, Philco Corp.; Lee Rogers, Lockheed Aircraft Corp.; John S. Seigle, Southern Bell; Lt. Col. Eliot C. Tobin.

Committee chairmen: civil defense—J. S. Bonner, Southern Bell; house—Capt. A. N. Christensen, Third Army; membership—W. B. Burnett, Southern Bell; program—A. J. Cartey, Southern Bell; publicity—E. P. Crutchfield, Western Union; reception—M. S. Butler, Southern Bell.

Arizona

The annual election was conducted at the chapter's September 17th meeting at Fort Huachuca Officers' Open Mess. Lt. Col. Carl F. Dietrich was chosen to head the chapter during the ensuing year.

Other officers named were: vice president—Lt. Col. Lloyd S. Snapp (Ret.); secretary-treasurer — John M. Kelly; board of directors—Col. Henry A. Keller, Dr. William M. Young, Leslie P. Van Houten and Capt. Albert R. Lane.

Baltimore

The initial meeting of the new year was held on September 18th at the Fort George G. Meade Officers' Club, with 80 members and guests in attendance.

Following dinner, President J. Walton Colvin called the meeting to order with a gavel presented to the chapter by the immediate past president, Trevor H. Clark. He thanked Col. Riley A. Graham and the Fort Meade staff for arranging the dinner-meeting and then introduced guests at the head table and other chapter officers as follows: Mrs. William M. Thames, Jr., wife of the guest speaker; Cdr. and Mrs. Bob Kirsten, USCG, executive vice president of the chapter; Col. and Mrs. Riley A. Graham, USA, vice president in charge of programs; Raymond P. Moore, Hoover Electronics, secretary; Thomas E. Thompson, The Martin Company, treasurer; Regional Vice President George C. Ruehl, Jr.; Trevor H. Clark, Westinghouse Electric Corp., chairman of the board; Charles L. Cogswell, Thompson Trailer Corp., director; Albert J. W. Novak, Hoover Electronics, director; Richard M. Henry, Westinghouse, council member; Mrs. John A. Shipley, recording secretary; and John A. Shipley, Baltimore News-Post, official photographer.

Guest speaker was Brig. Gen. William M. Thames, Jr., Commander of the U. S. Army Combat Surveillance Agency and Special Assistant to the Chief Signal Officer for Combat Surveillance. His subject was "Combat Area Surveillance."

General Thames explained combat surveillance and reviewed its progress from Civil War days to the present and, with the aid of slides, gave a vivid description of various radar systems. He also described the Combat Surveillance Agency which was organized in June 1957 and its mission.

President Colvin announced the appointment of the following committee to draft a program aimed to encourage secondary school students to enter scientific fields: John M. Pearce, The Martin Co.; George C. Ruehl, Jr.; Capt. Vernon E. Day, USCG; Col. Frank R. Swoger, USA(Ret.), Bendix Radio; George Owen, The Applied Physics Lab., Johns Hopkins University; and Cdr. Bob Kirsten, USCG.

Boston

Boston's Senior Commanders of the U. S. Army, Navy, Coast Guard and Air Force convened on September 24 for the first fall meeting of the Boston Chapter at the Charlestown Naval Officers' Club.

Guest speaker Colonel Robert J. Garrigan, Boston Air Defense Sector, USAF, spoke on the Semi-Automatic Ground Environment System (SAGE).

Honored guests of the evening were: Maj. Gen. William J. Verbeck, Commander, XIII U. S. Army Corps (Reserve), Fort Devens; RAdm. Carl F. Espe, Commandant, First Naval District, Boston; Capt. Fred L. Ruhlman, Commander, Boston Naval Shipyard; RAdm. Edwin J. Roland, Commander, First Coast Guard District, Boston; Maj. Gen. Kenneth P. Bergquist, Commander, Air Defense Systems Integration Division, L. G. Hanscom Field, Bedford, and Colonel Elmer W. Richardson, Commander, Air Force Cambridge Research Center.

Dayton-Wright

The first meeting of the 1959-60 season of the chapter was a joint meeting with the Institute of Navigation. The meeting, a dinner-dance, was held at the Officers' Club at Wright-Patterson AFB, September 18, and included an introduction and installation of the newly elected officers of each organization. (New chapter officers were reported in the July issue.)

During the evening, John L. Word, the student selected by Ohio State University as recipient of the AFCEA Scholarship Award for 1958-59, was introduced to the members.

Fort Monmouth

A record year in new memberships and attendance was forecast at the chapter's first fall meeting on September 17, held at Gibbs Hall Officers' Club.

A guest of honor at the opening dinner-meeting was Maj. Gen. W. Preston Corderman, USA (Ret.), formerly post commander and now president of Times Facsimile Corp., New York, a division of Litton Industries.

Guest speaker of the evening was Carl Jensen, a lamp expert from Westinghouse Electric Co., who gave a talk and demonstration on "The Magic Light Force of the Future." Mr. Jensen pointed out that the phenomenon of electroluminescence has been known for a good many years, but it has only been in the last few years that concentrated effort and manpower have been devoted to exploiting the many possibilities of this light source for the future. Electroluminescence does not depend on heating nor upon a gas discharge for its light output. No bulb is needed, no vapor is present; the light is produced in a film, a few thousandths of an inch thick. Light is generated by phosphors excited by an alternating electric field produced by an applied voltage.

(*Continued on page* 50)

Atlanta—*Shown at the head table at the September meeting are L to R, front row: B. S. Gilmer, Pres., Southern Bell Tel. & Tel.; Maj. Gen. R. T. Nelson, CSigO, US Army; A. E. Arnold, District Mgr., Western Union; Maj. Gen. T. E. DeShazo, Deputy C.G., 3rd U.S. Army. 2nd row: Lt. Col. T. A. Pugh, Deputy SigO, 3rd U. S. Army; Col. Kirk Buchak, Signal Officer, 3rd U. S. Army; Brig. Gen. D. P. Gibbs, C.G., U. S Army Signal Training Center; Brig Gen. H. D. Ives, Chief of Staff, 3rd U S. Army, and Lt. Col. L. J. Ross, Signal Supply Officer, Atlanta General Depot.*

Baltimore—*Pictured during the September dinner-meeting at Ft. George G. Meade are, L to R: Comdr. Bob Kirsten, USCG; Col. Riley A. Graham, USA; Brig. Gen. Wm. M. Thames, Jr., USA and J. Walton Colvin, chapter president.*

Dayton-Wright—*The first meeting of the 1959-60 season featured a dinner-dance. Pictured at the head table are, L to R: William Shade, newly elected chapter president; Mrs. Shade; J. J. Magill, retiring president; Mrs. Magill and Colonel W. H. Congdon, newly elected chapter vice president.*

Fort Monmouth—*"The Magic Light Force of the Future" was the program feature at the September dinner-meeting, held at Gibbs Hall Officers' Club. Pictured L to R are: Norman Freeman, chapter president; Carl Jensen, Guest Speaker, Westinghouse Corp.; Maj. Gen. W. Preston Corderman, former Post Commander, Fort Monmouth and now President, Times Facsimile Corp.*

Montgomery—*Pictured during the lecture demonstration entitled "The Day the Earth Tumbled" presented at the chapter's first annual meeting are L to R: Marlin Harris, Chairman, Montgomery Subsection, AIEE; Lt. Col. Herbert Herman, chapter president; Guest Speaker, Chan P. Thomas, Sales Engineer, General Electric Co.; W. Kelly Mosley, Regional Vice President, AFCEA and Harry B. Lackey, chapter vice president.*

Philadelphia—*Shown in the receiving line at the Barclay Hotel, preceding a dinner meeting in honor of Maj. Gen. R. T. Nelson, Maj. Gen. H. L. Scofield and their wives are L to R: Frank Langstroth, chapter president; Brig. Gen. E. L. Littell, C.G., U. S. Army Signal Supply Agency, vice president; Mrs. Littell; Maj. Gen. R. T. Nelson, CSigO, U. S. Army; Mrs. Nelson; Maj. Gen. H. L. Scofield, Chief, Procurement and Distribution Division, Office of CSigO and Mrs. Scofield.*

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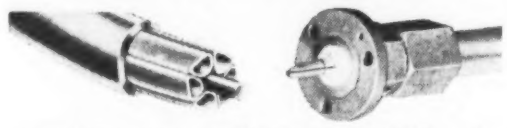

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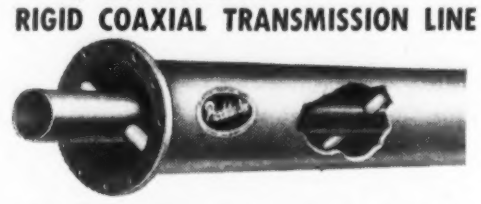

Ready to meet all demands, Prodelin rigid line is now available in Standard EIA copper, EIA lightweight aluminum and in aluminum with the new Spir-O-lok connectors. All lines feature the electrically transparent compensated pin supporting structure. This field proven feature allows peak powers which approach theoretrical values. The 3⅛" line can handle, at atmospheric pressures, peak powers of up to 3 megawatts with no additional pressurization.

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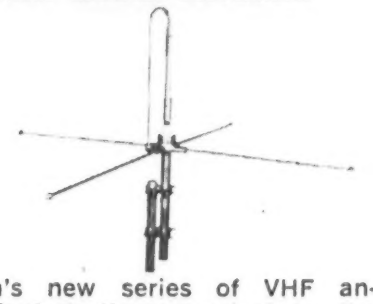

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Gulf Coast

S/Sgt. Stanley D. Bingston gave a talk entitled "Forward Propagation of Tropospheric Scatter Communications" to 120 members and guests assembled at the Airmen's Club, Keesler Air Force Base, for the monthly meeting, September 14.

Lt. Col. Paul C. Kiefer, Chapter President, explained the aims and accomplishments of AFCEA. Maj. Leslie B. Rosenberg, membership chairman, and Howard Yund, program chairman, presented reports.

Kansas City

At the Executive Committee Meeting September 1, plans for the coming year were discussed and Lt. Col. G. D. Meserve was elected chairman of the Armed Forces and Reserve Committee.

The chapter opened its activities with a dinner-meeting at the Officers' Club, Richards Gebaur Air Force Base, on September 24th. Guest speaker was Clifford G. Wassall, Defense Activities Engineer for the Southwestern Bell Telephone Company.

President W. E. Fisher welcomed the members and guests to the first meeting of 1959-60, with a special tribute to the chapter's seventeen new members. Special guests were Maj. Gen. and Mrs. W. W. Bowman, Commander, Central Air Defense Force, and Mr. W. G. Hole, Defense Communications Supervisor, Southwestern Bell Telephone Co.

Mr. Wassall's presentation concerned the role of communications in the defense of the United States. His discussion centered around the SAGE system and communications in connection with space vehicles and was illustrated by a film on SAGE entitled "In Your Defense" and movie slides on space vehicles.

Louisiana

W. P. Massey, Chapter President, presented an illustrated lecture on "Blessings of the U. S. A." at the September 15 meeting at the Naval Air Station, Commissioned Officers Mess, Alvin Callender Field. The business meeting was preceded by the social hour and dinner.

Montgomery

Mr. Chan P. Thomas, Sales Engineer from the General Electric Company, Ithaca, N. Y., presented a lecture demonstration entitled "The Day the Earth Tumbled," concerning the history of the Ice Age and the theories that are now being evolved, at the Chapter's first annual meeting held jointly with the Montgomery Subsection of the American Institute of Electrical Engineers.

Among the distinguished members and guests present at the meeting were: Mr. W. Kelly Mosley, Regional Vice President of AFCEA; Mr. Harry B. Lackey, Vice President of the Southern Bell Telephone Company and also Vice President of the Montgomery Area Chapter; and, Mr. Marlin Harris,

Chairman of the Montgomery Subsection of the AIEE. A number of distinguished visitors from the Birmingham section of the AIEE were also present.

Philadelphia

Maj. Gen. Ralph T. Nelson and Maj. Gen. Herbert L. Scofield and their wives were the guests of honor at a reception, cocktail party and buffet given by the chapter at the Barclay Hotel, August 7.

Among the nearly 200 members attending the event honoring Gen. Nelson, Chief Signal Officer, and Gen. Scofield. Chief, Procurement and Distribution Division, Office Chief Signal Officer, were Brig. Gen. Elmer L. Littell, Commanding General, U. S. Army Signal Supply Agency, Benjamin H. Oliver, Jr., AFCEA National President, and John Holland, AFCEA Regional Vice President.

Scott-St. Louis

The McDonnell Aircraft Corporation of St. Louis was host to the Chapter at the September 11 meeting.

An informal pre-meeting dinner was attended by 50 members and guests. The Chapter then toured the Corporation under the guidance of F. H. Roever, Administrative Engineer at McDonnell. R. M. Schwarz, Project Electronic Engineer, presented a lecture on "Weapon Systems Engineering and Electronics" and a film on the Model 119 Executive Jet Transport was shown. The meeting was closed by R. D. Hill, Jr., Manager, Electronics Systems.

Seattle

A field trip was made by the Chapter on August 15 to the U. S. Naval Radio Station, Jim Creek, Washington. The group toured the 1,000,000 watt radio station under the guidance of Cdr. Larkin and Lt. Humphrey. Of special interest was the tank tuning system and the matching device between the transmitter and the huge antenna system. Under changing weather conditions it necessitates almost continual tuning to assure constant maximum output.

On September 9, the Chapter held a business meeting at which Frank Simmonds was appointed membership chairman and Capt. Hill was appointed program chairman.

J. Alan Duncan, secretary of the Chapter, gave a talk on the totem polar region which included a short history of the art of carving totem poles and of the people of the area which covers the coastal lands from Puget Sound up through the coast of British Columbia and includes southeastern Alaska.

South Texas

The chapter's first fall meeting took place on September 15th and was addressed by E. S. C. Coppock, owner and operator of the Trendex Research

(*Continued on page* 64)

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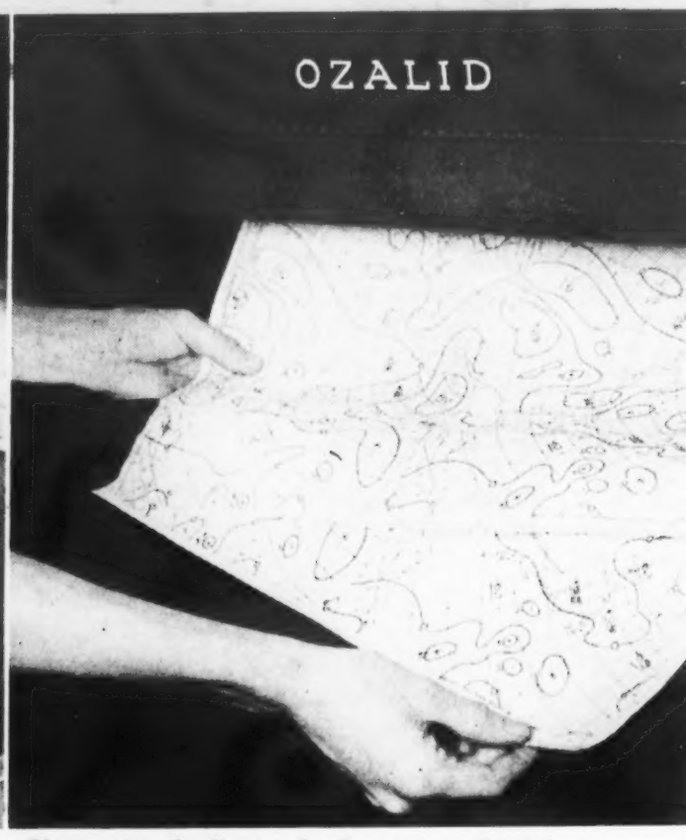

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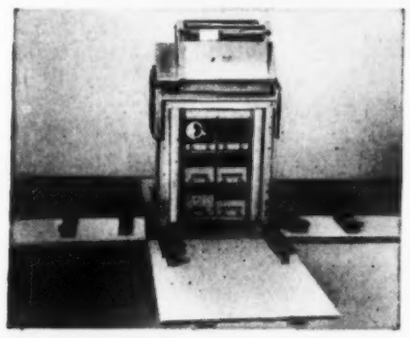
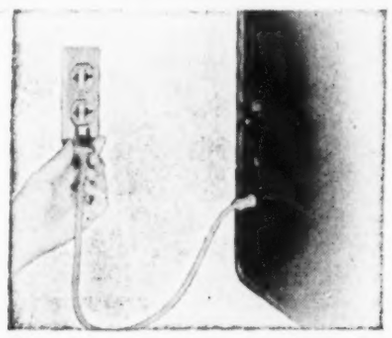
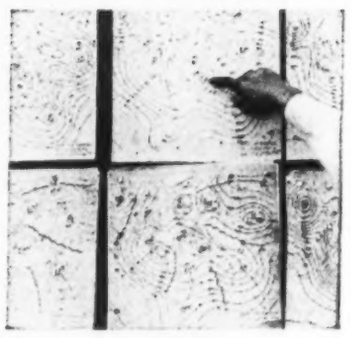


Uncrate

Roll in



Plug in



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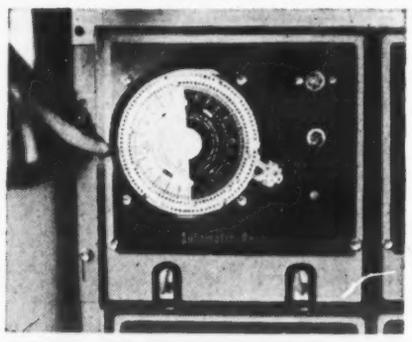
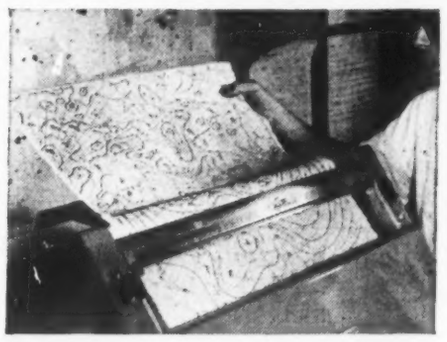
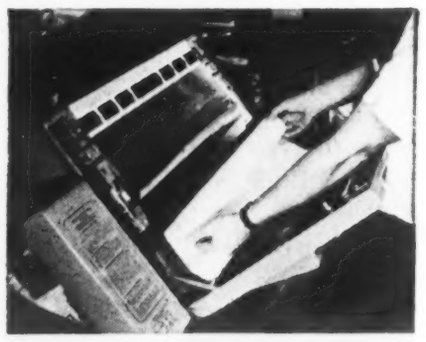


Time clock programming



Instantly visible



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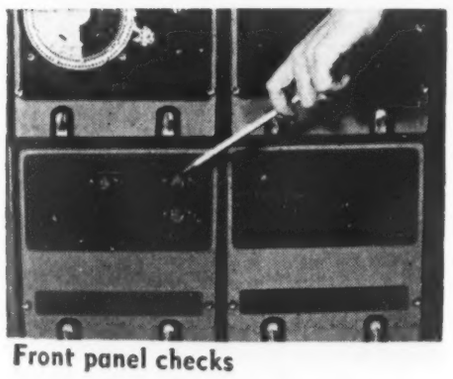
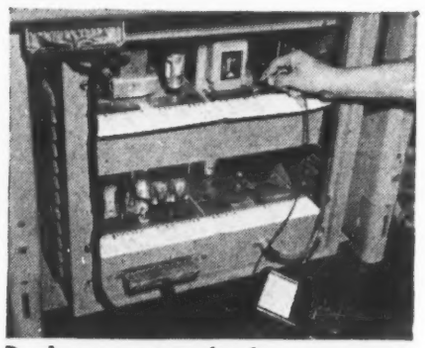
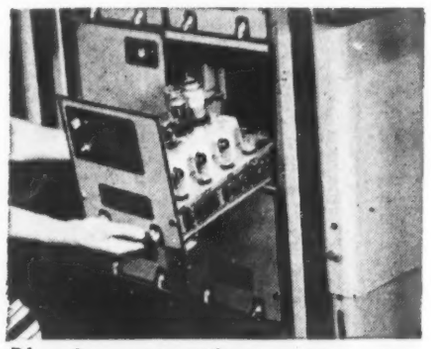


Front panel checks



Back connector checks



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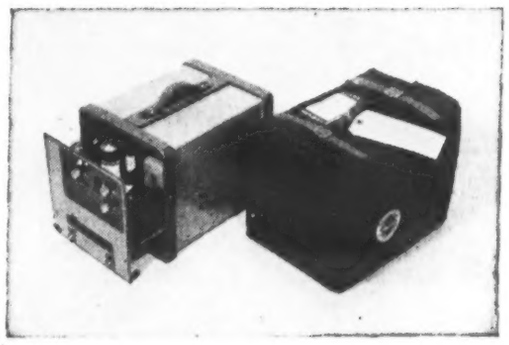

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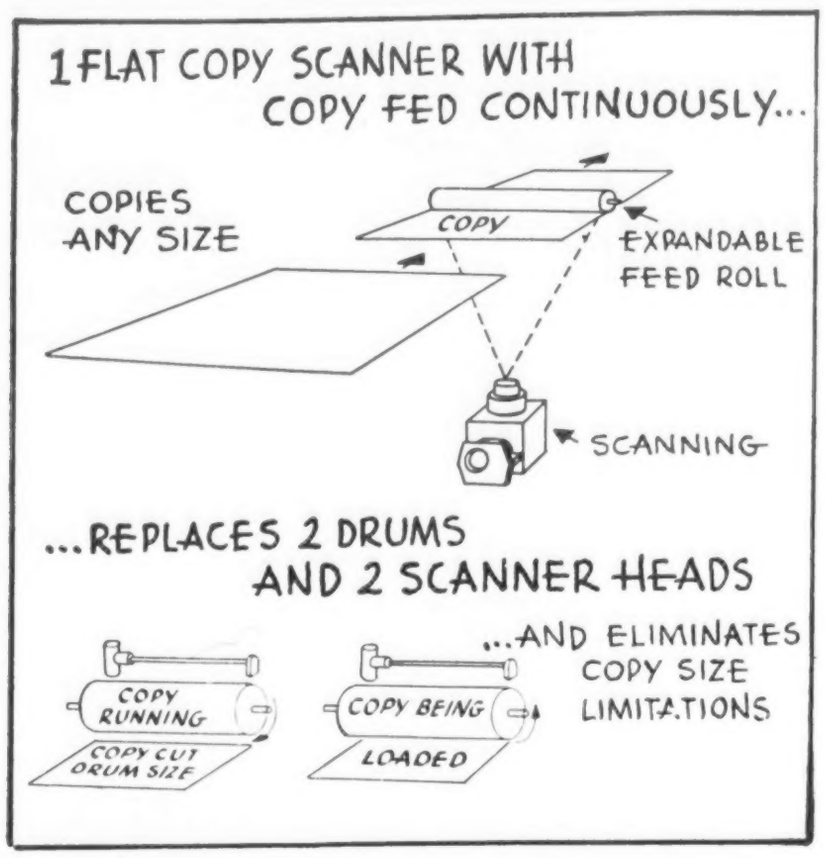

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*Fifteen out of twenty forecasters after having operating experience with all weather facsimile systems indicated a *marked preference for* Alden Recorders and Alfax Maps.

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Compact, mobile flat copy scanners provided by Alden Electronics Company, Westboro, Mass. moved onto the new U.S. Weather Bureau Hi-altitude Weather Facsimile Network Feb. 16, 1959 to begin a new era in simplified facsimile communications systems.

• INSTALLATION SIMPLIFIED . . .

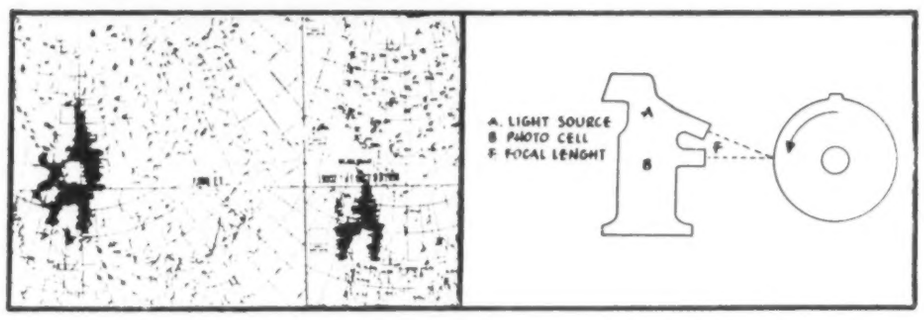
Uncrated from fold-a-way shipping boxes at Suitland, Maryland, and Idlewild, N.Y. — Alden scanners rolled in, plugged in and turned on to begin new era in weather facsimilie networks. Tested in 2 hours for 60, 90, 120 rpm, the equipment was turned over to the U.S. Weather Bureau personnel the same day. Addition of transmission and receiving points has been expanded with *higher speed operation* of 120 rpm started June 20th on completion of line balancing by American Telephone and Telegraph Co. which doubled the speed, transmitting copy of the same detail (size of characters and information *not* enlarged) as at 60 rpm.

• EASE OF COPY HANDLING . . .

With map sizes no longer restricted to drum mounting, continuous transmissions of maps (one after the other) with one scanner halves the space and maintenance problems, makes possible *scanning the original* plotted maps without cutting to size; map plotters and forecasters have *originals back in ½ the time.*

Flat Copy Scanner with expandable copy feed head takes maps any width or length — fed straight or kitty corner.

• FOCUS SMUDGE ELIMINATED



Focus smudge caused by unusually thick copy or copy lifting from drum.

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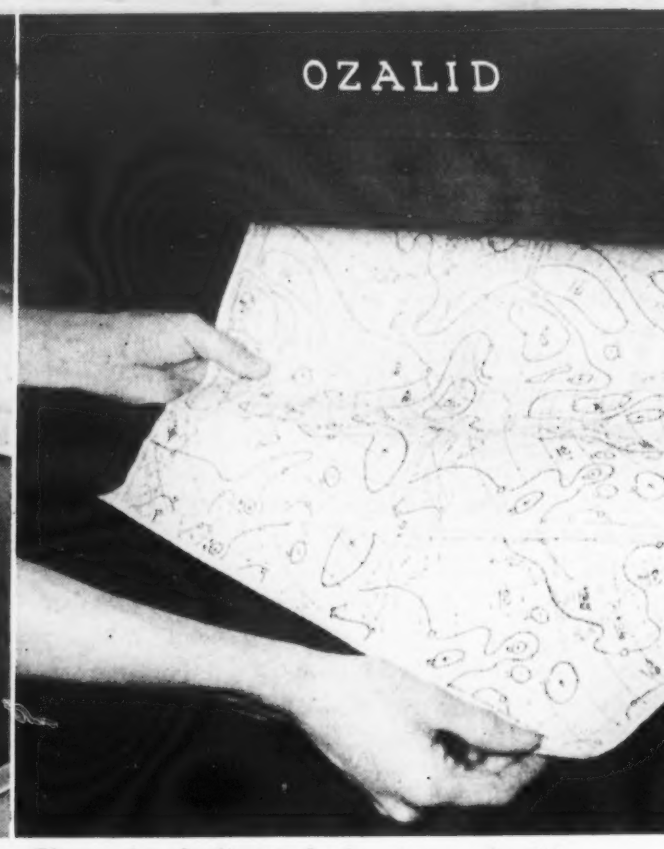

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Clear crisp duplicates by Bruning or Ozalid

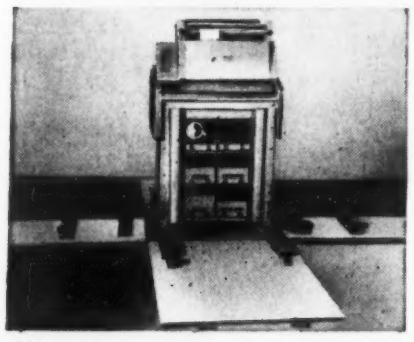
- PLUS THESE UNIQUE FEATURES . . .

LOW COST—Alfax paper cost savings on full schedule operation save 1/3 to 2/3 in yearly operation costs.
CLEAN—electricity is the ink for Alfax paper, ion deposits make crisp brown marks without dust, smudge or chemical irritants.
STABLE Alfax stores indefinitely . . . contains no voids or splices . . . recording marks are permanent.

Here's why . . . FORECASTERS PREFER EQUIPMENT AND ALFA

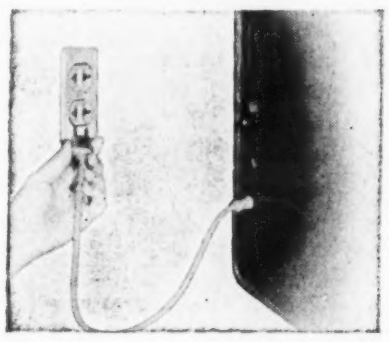
Most commended features of ALDEN RECORDERS

- ***EASE OF INSTALLATION*** . . . **compact and mobile**

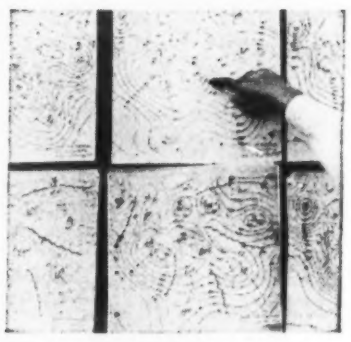


Uncrate

Roll in



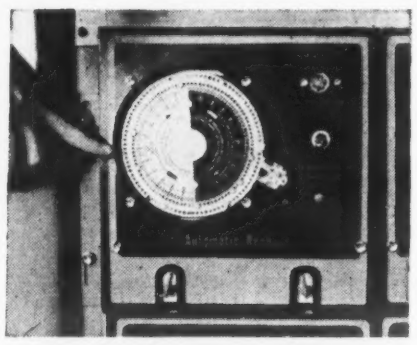
Plug in



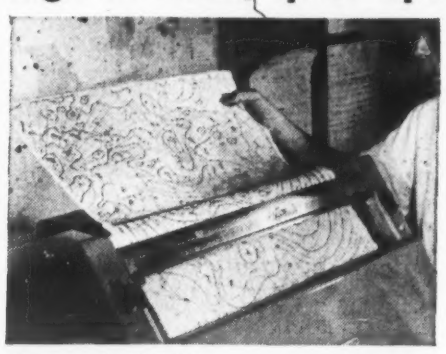
Clean crisp maps

- ***EASE OF OPERATION*** . . . **new high in clean, quiet operation**

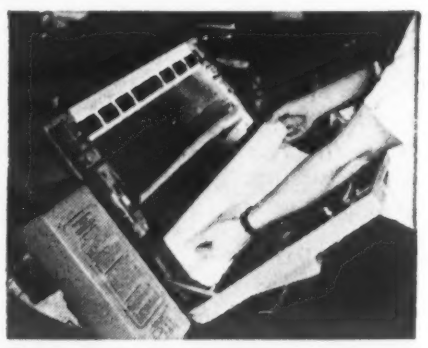
Automatic and continuous



Time clock programming

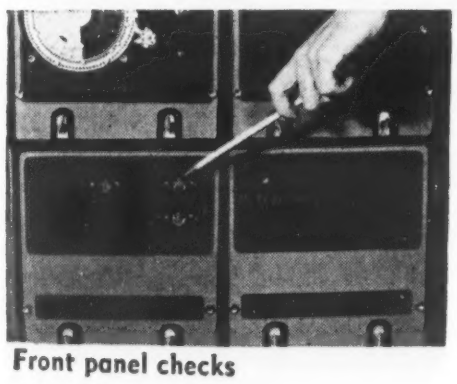


Instantly visible

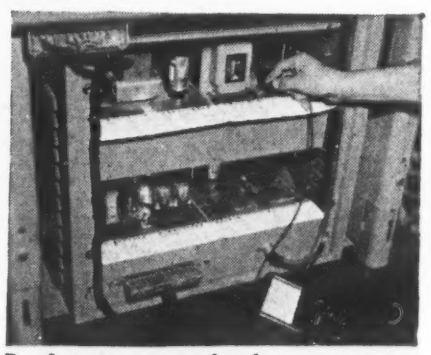


Easy paper loading

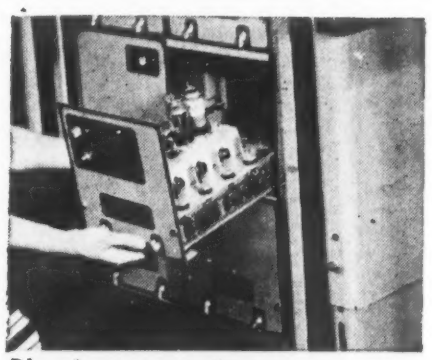
- ***EASE OF MAINTENANCE*** . . .



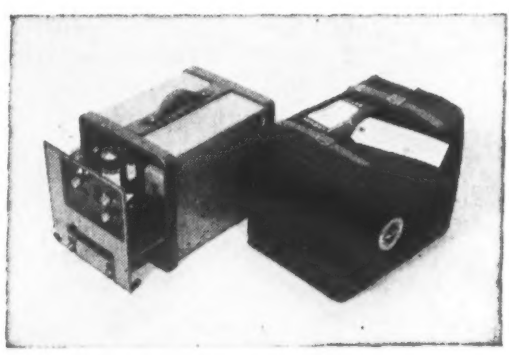
Front panel checks



Back connector checks



Plug-in construction

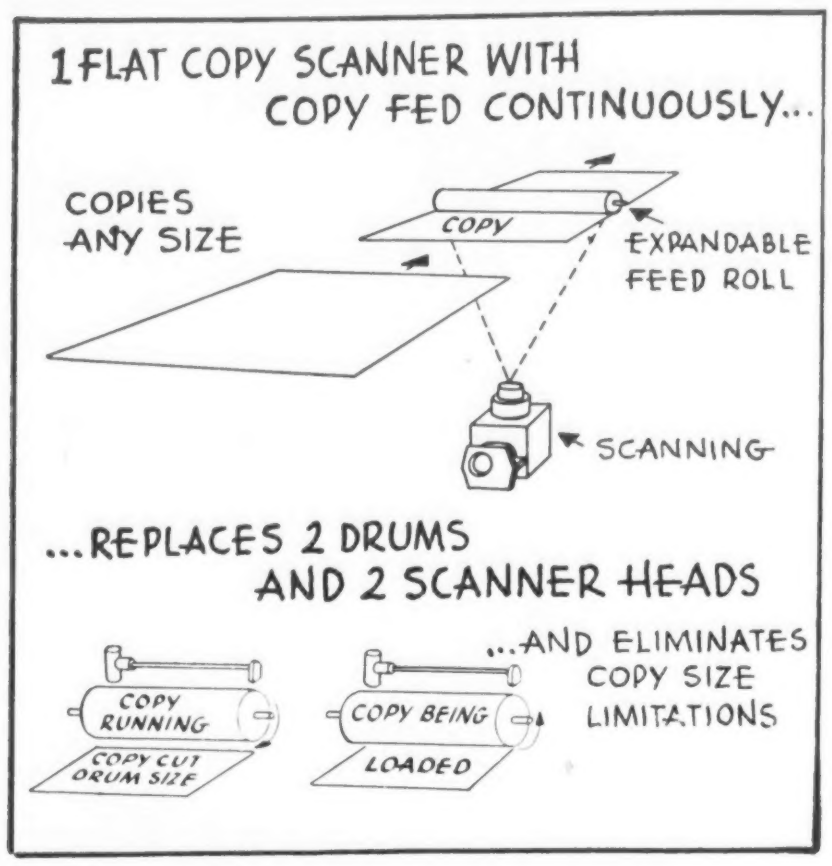


Air Freight replacement

- PLUS THESE UNIQUE FEATURES . . .

SECURITY—low voltage marking process does not generate a signal that can be intercepted.
HIGH SPEEDS—60-90 or 120 rpm operation . . . recorder technique and paper capable of fifteen times these existing speeds.
PRODUCTION—designed for volume production on short lead time . . . using unique expandable manufacturing techniques.

NEW BOON TO CONTINUOUS FACSIMILE NETWORK OPERATION REALIZED WITH ALDEN FLAT COPY SCANNING SYSTEM



R* FAX ALDEN FACSIMILE MAPS...

. . . and why we think you'll like them too.

Since 1954 Alden Facsimile Weather Map Recorders and Alfax maps have been replacing existing facsimile equipment on the National facsimile Weather Map Network at an accelerating rate.

U. S. Weather Bureau stations converting to Alden equipment will be complete by the end of the fiscal year with many independent forecasters, air lines and institutions following suit.

The new U. S. Weather Bureau's high altitude weather network, local and overseas networks are being expanded with Alden Facsimile Recorders and continuous flat copy scanners.

*Fifteen out of twenty forecasters after having operating experience with all weather facsimile systems indicated a *marked preference for* Alden Recorders and Alfax Maps.

ALDEN ELECTRONIC AND IMPULSE RECORDING EQUIPMENT CO., INC.
Westboro, Mass.

Compact, mobile flat copy scanners provided by Alden Electronics Company, Westboro, Mass. moved onto the new U.S. Weather Bureau Hi-altitude Weather Facsimile Network Feb. 16, 1959 to begin a new era in simplified facsimile communications systems.

- **INSTALLATION SIMPLIFIED . . .**

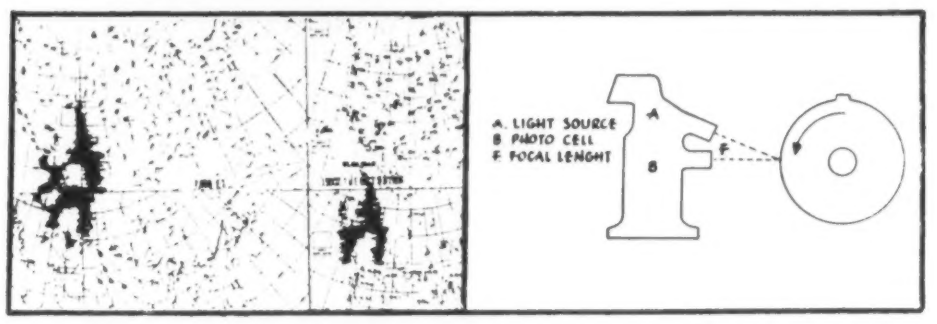
  Uncrated from fold-a-way shipping boxes at Suitland, Maryland, and Idlewild, N.Y. — Alden scanners rolled in, plugged in and turned on to begin new era in weather facsimilie networks. Tested in 2 hours for 60, 90, 120 rpm, the equipment was turned over to the U.S. Weather Bureau personnel the same day. Addition of transmission and receiving points has been expanded with *higher speed operation* of 120 rpm started June 20th on completion of line balancing by American Telephone and Telegraph Co. which doubled the speed, transmitting copy of the same detail (size of characters and information *not* enlarged) as at 60 rpm.

- **EASE OF COPY HANDLING . . .**

With map sizes no longer restricted to drum mounting, continuous transmissions of maps (one after the other) with one scanner halves the space and maintenance problems, makes possible *scanning the original* plotted maps without cutting to size; map plotters and forecasters have *originals back in ½ the time.*

Flat Copy Scanner with expandable copy feed head takes maps any width or length — fed straight or kitty corner.

- **FOCUS SMUDGE ELIMINATED**



Focus smudge caused by unusually thick copy or copy lifting from drum.

With copy feed rolls precisely positioning surface of map on flat copy scanner table, exact focal lengths are maintained for clear, sharp recordings.

- **MOST COMMENDED FEATURES**

  Personnel familiar with prior facsimile scanning techniques, lauding this new breakthrough in weather facsimile techniques, highly commend these features:

  - **ease of copy handling**
  - **compactness and mobility of equipment**
  - **quietness and dependability of operation**
  - **cleanness and sharpness of copy produced**

Hi-Altitude Facsimile Weather Drops

will soon be available from American Telephone and Telegraph Co. for qualified companies and organizations. For others interested in facsimile communication systems, Alden Electronics makes flat copy scanner heads and recorders in all sizes and speeds (up to 30 times present network speeds) furnishing components to qualified manufacturers, and complete systems to end customers.

We invite your inquiry .

NEWS ITEMS AND NEW PRODUCTS

Funds for the performance of research and development in private industrial firms totaled $7.2 billion in 1957, according to the National Science Foundation. Slightly more than one-half of this amount was accounted for by two industries—aircraft and parts, and electrical equipment.

A preliminary report entitled, "Funds for Research and Development Performance in American Industry, 1957," *Reviews of Data on Research & Development,* No. 14, describes a survey conducted for the Foundation by the Bureau of the Census, U. S. Department of Commerce.

Total performance of research and development in private industrial firms, as reported in the survey, increased about one-fifth between the two years covered, 1956 and 1957, from $6 billion to $7.2 billion. The survey also showed that during 1957, $3.7 billion, or slightly more than one-half of the total research and development performed by private industrial firms, was financed by the Federal Government. Federally financed research and development in private industrial firms was shown to be heavily concentrated in the aircraft and parts industry, which accounted for almost three-fifths of the $3.7 billion.

Eight separately surveyed industries (paper and allied products; drugs and medicines; other chemicals; stone, clay, and glass products; industrial chemicals; petroleum refining and extraction; food and kindred products; and primary metal industries) supplied from company funds more than 90 percent of their respective totals for research and development. In contrast, more than four-fifths of the research and development performance in the aircraft and parts industry was supported by the Federal Government.

• • •

The nuclear powered submarine, *George Washington,* has an especially constructed switchboard that was designed and built to be installed in the submarine through a 25-inch hatchway, Navy spokesmen said. The switchboard is the nerve center of the missile weapons system and major clearing house for transmitting and switching power and information to and from the fire control panel which launches the Polaris missile.

Built by Burroughs Corporation of Detroit, the switchboard curves to fit the hull and is installed in two sections to meet space limitations. The weapons systems transmit digital information, synchronization and power data which checks missile environmental conditions, activates storage batteries, feeds navigational data to fire control equipment and prepares information to operate launching equipment through the board.

The switchboard is composed of 12 cabinet units which fill an area of 20 feet long by six feet high. Each unit utilizes about 20 square inches of floor space. There are 135,000 connections and 265,000 feet of wiring for each switchboard.

• • •

The Industrial Education Institute in cooperation with the Materials Handling Institute has planned a 5-day training course in Value Engineering and Analysis for industry and government, starting November 30. The program covers all phases of the subject and is designed for men responsible for product design, procurement and manufacturing.

Value Engineering and Analysis has been termed "the most effective technique ever developed for reducing product costs." It is a concentrated effort to improve the value of any product by eliminating unnecessary costs in product design, manufacture and procurement. (See SIGNAL, June 1957, page 15, and October 1958, page 40.) The intensive course will combine formal instruction, guest lectures, informal discussion, demonstration, case study and problem solving.

The members of the "faculty" include nearly a score of the Nation's foremost authorities on improving product value. They include L. D. Miles, Manager of Value Services, General Electric Co.; RAdm. A. G. Mumma, USN(Ret.), Vice President, Engineering, Worthington Corp.; RAdm. R. S. Mandelkorn, USN (Ret.), Chairman of Value Engineering Committee, Electronics Industries Association; Vincent de P. Goubeau, Vice President, Materials, Radio Corporation of America; Frederick S. Sherwin, Manager, Value Analysis Service, Raytheon Co.; Don Otis, Controller, Electric Typewriter Division, I.B.M. Corp.; Bernard W. Eades, Manager, Value Engineering, Stromberg-Carlson Co., and President of the Society of American Value Engineers; Raymond J. Spenard, Value Analysis Education, U. S. Army Ordnance; Morgan D. Roderick, Office of Value Engineering, Bureau of Ships, U. S. Navy; Louis J. De Rose, Executive Director, Materials Management Institute, and others.

Further details and registration information may be obtained from the Registrar, Industrial Education Institute, 25 Huntington Avenue, Boston 16, Mass.

• • •

A new Index of Commercial Standards revised to July 1, 1959, lists all Commercial Standards under 22 classifications including electrical and mechanical equipment, instruments and tools, chemicals, plastics, precious metals, rubber products, paper and petroleum products.

Commercial Standards are voluntary standards adopted by industry to establish nationally recognized quality requirements, including methods of testing, rating or grading. They are developed at the request of the industry concerned to form a common basis of understanding among producers, distributors and users of the products, and to provide a basis for fair competition.

Single copies of the Index, Catalog No. 978, are available without charge upon request to Commodity Standards Division, U. S. Department of Commerce, Washington 25, D. C.

• • •

Cornell Aeronautical Laboratory (CAL) will design and build the world's first wind tunnel for long-duration testing of hypersonic missiles and space vehicles under actual atmospheric conditions.

Under a $3.1 million contract with the Air Force Research and Development Command, CAL will operate the new tunnel at its main research center in Buffalo. The Laboratory will also complete the engineering and design work initiated under previous Air Force contracts on the "wave superheater" which will sup-

AN ACHIEVEMENT IN DEFENSE ELECTRONICS

NEW AMPLIFIER PACKS 90 DB IN HALF CUBIC INCH VOLUME

New 455 kc three-stage amplifiers developed by the U.S. Army Signal Corps utilizing the facilities and competence of General Electric produce up to 90 db gain with 5 kc bandwidth in one-half cubic inch volume. This degree of miniaturization evolved from sustained research and development in solid state filters, delay lines and transformers at the Electronics Laboratory, Electronics Park.

The unique bar-shaped transformers developed for these amplifiers, combined with improvements in existing ferro-electric ceramics, permits the most compact packaging with extreme gain. This achievement in research and development is indicative of General Electric's technical competence in defense electronics.

227-2B

Progress Is Our Most Important Product

GENERAL ELECTRIC

DEFENSE ELECTRONICS DIVISION
HEAVY MILITARY ELECTRONICS DEPARTMENT
SYRACUSE, NEW YORK

ply high-temperature, high velocity air flows for the new tunnel which will generate airflows approximating 10,000 miles an hour and temperatures of 9,000° F. It will be capable of 15-second test durations, considerably longer than possible before at such extreme temperatures, air speeds and at pressures corresponding to actual flight altitudes. The installation will begin operation in two years, according to Ira G. Ross, President of CAL.

• • •

Two new airborne digital computers, developed under the Army-Navy Instrumentation Program, were displayed today at the ANIP symposium in Dallas. Spokesmen for Litton Industries, developers of the computers, said that advanced digital techniques evolved from these two programs have been applied directly to Litton's work on the attack-navigation computer for the Navy's A2F weapon system and will also be used on the Eagle missile tactical computer.

Both computers displayed in Dallas are compact and light weight models. A helicopter central control computer, to be flown in Bell Helicopter Corporation's HU-1A, will furnish navigation, flight performance, and cruise control information continually updated to provide an optimum flight plan for the pilot or autopilot.

The AIDE IV computer will be used by Naval Air Development Center for flight and lab test system evaluation. While its design was directed toward solving the bombing-navigation requirements of the DV-10 system, its development led directly to the basic design techniques of the DIANE digital computer for the A2F aircraft.

• • •

The Business and Defense Services, U. S. Department of Commerce, has announced a change in the priorities regulations covering electronic components and parts, under which manufacturers of power and transmitting electron tubes may reserve small fixed percentages for commercial orders. In the past the entire output of these tubes has been subject to the demands of rated (defense) orders.

In general, the change will permit manufacturers to reserve from 20 to 30 percent of their monthly production for commercial sales, depending on the item involved. The change was effected by issuance of an amended Order M-17, to bring power and transmitting electron tubes within its scope. Prior to the change, Order M-17 covered only transistors, crystal diodes and electron tubes other than power and transmitting types.

Order M-17, which has been in effect since early in the Korean outbreak, is intended to provide equitable distribution of rated orders among manufacturers of the specified components, in order to achieve maximum production and to reduce to a minimum disruption of normal distribution.

In the amended order, effective as of September 4, 1959, the alternative base period on which a manufacturer's production level is to be computed has been brought up to date by changing it to the 6 calendar months preceding receipt of the rated order involved.

• • •

Five-hundred kilobit PCM pulses were transmitted successfully over a 93 mile tropospheric scatter path by the Communications Department, U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J. A 12-voice channel pulse code modulation signal was transmitted from Tobyhanna Signal Depot, Tobyhanna, Penn. to the Hexagon, Ft. Monmouth, N. J. This represents the first known transmission of high bit rate PCM information over distances greater than line sight. Previously the use of PCM multiplex equipment with microwave radio systems was limited to approximately 30 miles.

Fifteen-foot parabolic antennas were used at transmitting and receiving ends of the path with one kw of power transmitted. The circuit was operated on a one-way basis, transmitting from Tobyhanna to Ft. Monmouth. The operating frequency was approximately 1830 mcs. The equipment used consisted completely of existing USASRDL materiel and required no new developments. These equipments were Signal Corps Radio Set AN/GRC-50 built by Radio Corporation of America, Camden, N. J., Signal Corps Multiplexer Set AN/TCC-40 built by Raytheon, Waltham, Mass. and a microwave power amplifier built by International Telephone and Telegraph Laboratories, Nutley, N.J. Subjective talking tests made over the path indicate that voice transmission is not degraded by the randomly varying scatter signal above threshold. Diversity was not used for these tests indicating that further improvement can be achieved. Tests are currently being made to determine the percentage time on an hourly basis that the transmission is below the system threshold.

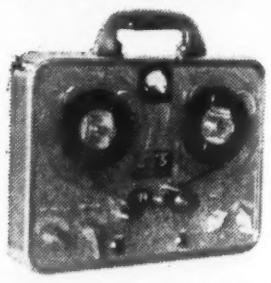
• • •

A new method of deposited carbon resistor manufacture permits the reduction in size and weight of the electronic component by more than 50% according to the International Resistance Co., Philadelphia.

The company explained that development of a new deposited carbon alloy which required a re-design of almost every element in the resistor resulted in the achievement. An insulating spiral path which determines the resistance value, is now diamond-cut in the much harder alloy film rather than sandblasted as formerly. The result is a more precise incision with consequent improvement in stability and reliability.

The highly conductive terminating point, which bonds the end-cap connections to the film, is still another new development. Over the resistance element are two new types of moisture resistant undercoat, also especially developed for this product. Completing the double-barrier insulation is a new type molded, break-resistant casing, which though heavy duty, is well within MIL size. The molded insulation results in improved

New TransFlyweight™
Professional Transistorized Electric-Motor Battery-Operated Portable Field Recorder
Exceeds NARTB Broadcast Standards



Check These Unusual Features:
- Equiv. Playback Input Noise: 0.25 Microvolts.
- Weight: 8 lbs.; Size: 5½ x 9 x 12 inches.
- Overall Gain: 110 db.
- Min. Input Voltage: 30 Microvolts.
- Input Impedance: Mike. 50/200 Ohms.
- Output Impedance: 15,000 Ohms.
- Output Level: 2.5 Volts.
- Bias Frequency: 90 KC.
- Batteries: Dry Rechargeable or Replaceable.
- Battery Life: Amplifier 125 hrs., Motor 40 hrs.
- Construction: Modular Plug-In.
- Guarantee: Unconditional Two Year.
- Choice of 1, 2, or 3-Speed Models.
- Prices from $386. to $446.

Write for complete information to:

AMPLIFIER CORP. of AMERICA
398 Broadway, New York 13, N. Y.

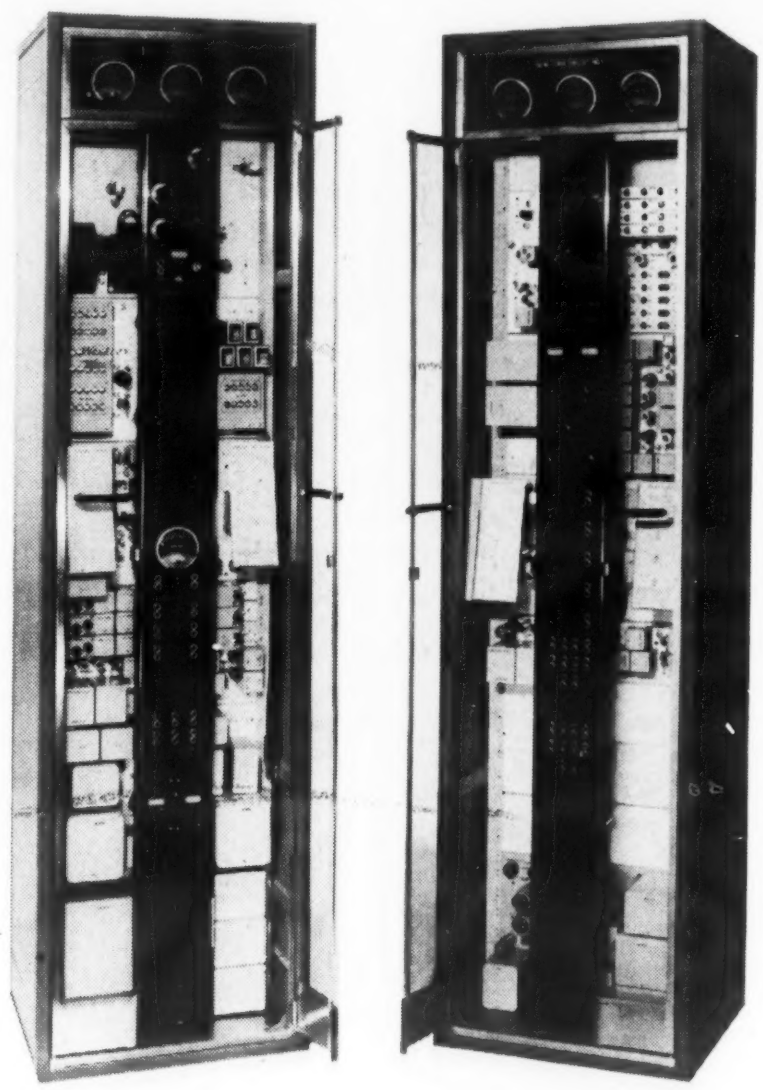
WHY is WESTREX PLEXITEL the most advanced single sideband radio communications system?

Single sideband radio transmission systems have been in use since the early 1930's. At Westrex we were among the pioneers with these systems and, in fact, Westrex has engineered and installed in foreign countries the majority of the commercial overseas point-to-point single sideband radio telephone circuits in use today.

The advantages of SSB are obvious. With one sideband suppressed, power thus saved is available for the remaining sideband, and tube load is much reduced. SSB transmission conserves space in the frequency spectrum, requires only a fraction of the power of double sideband, and provides a gain of approximately 9 db in signal-to-noise ratio.

Systems design through the years has evolved into very compact units. Today the Westrex Plexitel transmitter and receiver are each contained in a cabinet 84 inches high, 22¼ inches wide, and 17 inches deep. A lot of capability is packed into that space.

The transmitter provides a peak power output of 500 watts on any of ten predetermined crystal-controlled frequencies in the range of 3-30 megacycles. It is available in a number of combinations which permit the transmission of 1, 2, 3, or 4 separate telephone channels or each of these 3 kc voice channels may be selected to transmit up to 16 channels of radio printer intelligence, giving a total of 64 teleprinter channels. Facilities for channel grouping are an optional feature and may be added as future requirements dictate. Various linear amplifier combinations up to 10 kw may be used with the 8A transmitter.



The channel arrangement of the Westrex receiver in the Plexitel System is identical with that of the transmitter. Each 6 kc sideband may be used as a whole or subdivided into multi-message channels by appropriate optional equipment. As many as ten crystal-controlled frequencies may be pre-set for rapid selection by one manually operated knob. Remote control equipment is available which will activate or deactivate the receiver and select any one of the ten channels.

Both transmitter and receiver are designed to operate at altitudes up to 10,000 feet and under severe climatic conditions. Frequency stability of the Plexitel System is in the order of ±3 parts in ten million per day. No other SSB system is so conveniently adaptable to simple point-to-point, aviation ground, or marine applications; or to the more complex point-to-point radio system applications.

The 8A transmitter or 52A receiver may be used with any SSB system having similar characteristics and may also be operated on AM or DSB.

The many high quality refinements of construction are listed in our Plexitel brochure. We will send you your copy by return mail. Westrex Corporation, 111 Eighth Avenue, New York 11, N.Y.

Westrex Corporation
A DIVISION OF LITTON INDUSTRIES

load-life characteristics, better dielectric characteristics, and greater opposition to the effects of moisture.

The resistors are available in ¼ watt, ½ watt and 1 watt sizes in resistance from 10 ohms to 25 megohms. Standard tolerance is 1%, although 0.5 and 2% types are also available.

• • •

The American Standards Association has approved a new publication designed to help authors prepare clear and legible illustrations for technical papers and articles.

Published by The American Society of Mechanical Engineers, the *American Standard Illustrations for Publication and Projection*, Y 15.1-1959, describes a standard method for preparing graphs, line drawings and tabular illustrations for technical publications and slide projection.

The standard represents the consensus of national technical societies and trade groups most concerned with the subject. Such a consensus must be established before a standard will be accepted as an American Standard by the American Standards Association.

The publication is available at $2.00 a copy from the American Standards Association, 70 East 45th Street, New York 17, N.Y., or from The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

• • •

Plans to establish a nationwide chain of large-scale computer service centers, were announced recently by C-E-I-R, Inc.

The company has ordered three IBM 7090 computers to be installed in the New York City, Houston and Washington, D. C. areas. These machines, five times faster than the largest computers in use today, will serve the computing needs of business, industry and government in the East and Southwest. A comparable machine, to be chosen from among the various high speed computers to be available in 1960, will be installed in Chicago to serve the Midwest. These computers are expected to be installed in 1960 and early 1961, as soon as delivery can be obtained from the manufacturers. C-E-I-R also expects to operate a computer in Los Angeles by mid-1961.

Providing business and industry nationwide access to the coming generation of computers is the purpose of the large-scale plans. Dr. Herbert W. Robinson. President of C-E-I-R explained, "These machines will be absolutely essential because their great computing speed will enable them to solve problems at a far lower cost per solution than is possible by present machines. The new computers are so expensive that they must be kept continually busy on productive work, almost around the clock, before the huge cost of a computer installation can be recovered. It will be difficult for many companies, even large ones, to keep one of these lightning-fast machines completely occupied on company problems."

Dr. Robinson concluded, "In order to remain competitive, therefore, both large and small businesses will need computer services in precisely the units of time required to solve each particular problem. By means of this time-sharing at large-scale computing centers, all companies will be able to obtain the benefits of high-speed computers."

It is planned that each of the computing centers in New York, Houston, Chicago and Los Angeles will be built up to a personnel strength of about 200. C-E-I-R's Arlington Research Center, which operates the IBM 704 and 709 systems, expects to increase its present staff of 200 to 500 after the IBM 7090 is installed. The variety of services available at each regional center will include analysis of clients' problems, developing the techniques to solve the problems, programming the computer, and running the problems on the computer.

• • •

The Nippon Audio Kogyo Co., Ltd., of International Transistor Corp., Tokyo, is manufacturing transistor telephones.

Model DT-E is a table phone with dial and signal button. The telephone's individual number dial permits interconnection among ten stations, each station capable of selecting any number from one to ten.

As each set is an automatic dial master phone, no switchboard is required for this type telephone.

• • •

How do you "de-pot" a potted electronic component? The Manufacturing Methods Division of Aeronautical Systems Center of Air Materiel Command has sent letters to aircraft and electronic industries requesting suggestions as to what processes might accomplish this task.

The answer would save millions of Air Force dollars spent because potted circuitry components, those encased in resinous or epoxy-type substances usually are discarded because it is too expensive to reclaim them.

In some instances, wiring circuits for control of impulses generated to gunsights, radar units and communication equipment are encased in the resinous substance to protect them from environmental conditions and for many other reasons. One individual item on the circuit board can go bad and destroy usefulness of the entire circuit system.

Field units normally replace the whole circuit board or the sealed component and forward the discard to one of Air Materiel Command's depots for repair. The unit is subjected to reclamation, but usually the individual bad item cannot be forced out of the sealant substance without damage to other elements.

An acceptable, inexpensive depotting technique would reduce the cost of electronic assembly repairs. and would effect greater material savings through efficient salvage, equipment savings through parts damage and reduced cost of incorporating design changes.

Following final evaluation of replies, requests for proposals will be forwarded to those companies interested and eventually a contract will be awarded to delve into the "depotting" problem.

• • •

Literally one of the quietest rooms on Earth, an enlarged "anechoic chamber" has been installed in the Federal Sign and Signal Corporation's new plant in Blue Island, Illinois.

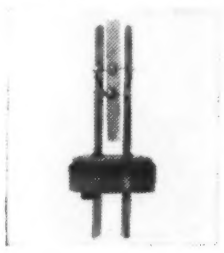
Reported to be the largest such chamber in the signal industry, the room is designed to test all types of signals from small buzzers to giant Thunderbolt air raid sirens. The room within a room has walls, ceiling and floor covered completely with wedges of fiberglass sound absorbing material in order to eliminate echoes and keep out all sounds but the one being tested.

Federal Sign and Signal Corp. recently moved its general offices and Chicago production operations from Chicago to the one-story plant in Blue Island. The modern 164,000 sq.ft. plant contains extensive facilities for the design and manufacture of audible and visual signals for industry and government. The company has streamlined its production, testing and research and development operations and is now able to expand its

Pilot Production of Grown Quartz Crystals Achieved at Western Electric

Quartz crystal units are manufactured by Western Electric for use by the Bell System in almost all long distance communication systems. Quartz is noted for its piezoelectric characteristic: when an electrical impulse is applied, there is a resulting mechanical motion. Moreover, a plate cut from quartz crystal will oscillate at one specific frequency, which can be made a few cycles per second or up to millions of cycles per second, by precisely controlling physical dimensions of the plate.

The piezoelectric characteristic of quartz is utilized by the Bell System in filters, oscillators and other devices. Thousands of quartz crystal units, each designed to respond to a specific frequency, are used as a means of separating the individual conversations from the multi-message signals transmitted over the same telephone channel.



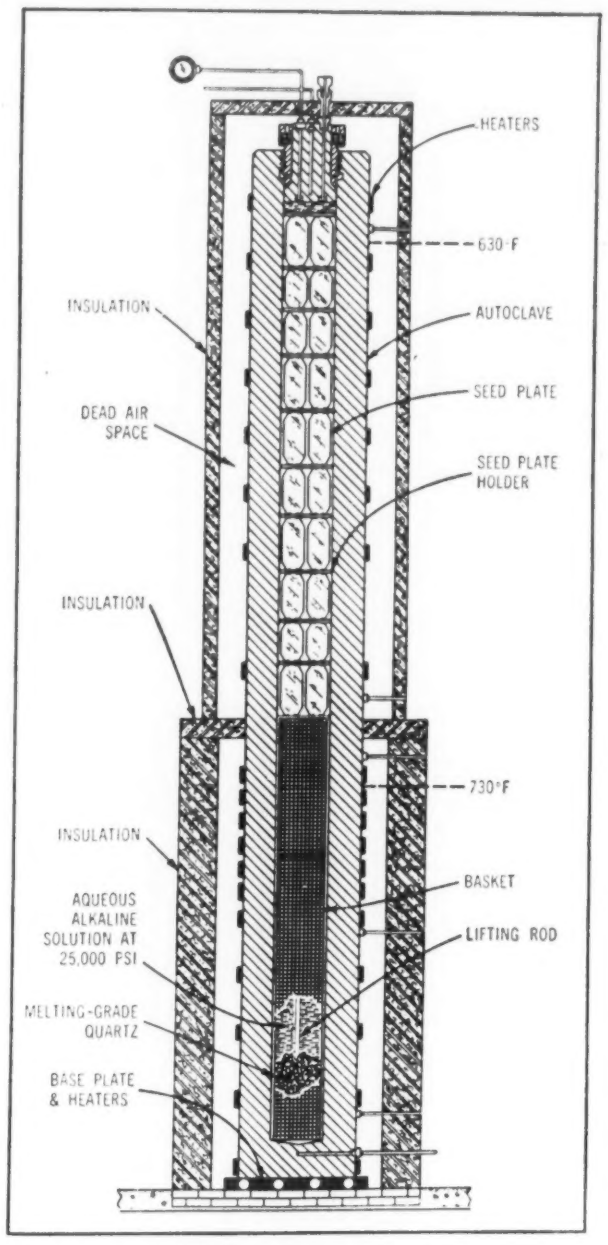
Crystal unit (without cover).

Deposits of quartz crystals are found in many parts of the world and are probably the result of natural processes over a period of centuries which may no longer be operating. Natural quartz crystals of suitable size and quality for telephone use are from a foreign source of supply which has become somewhat unstable and costly.

Man-Made Quartz

The instability of this foreign supply, especially in time of national emergency, and the increasing cost of high quality natural crystals accentuated the need for a domestic source. Realizing this, our research colleagues at Bell Telephone Laboratories started experimental work on synthetic quartz in 1946, culminating in a hydrothermal laboratory process in which crystals were "grown" successfully from thin quartz "seed" plates.

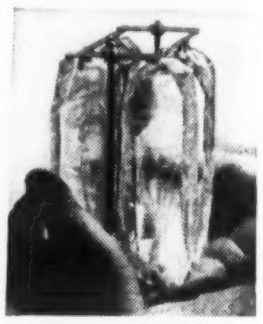
Basically, the hydrothermal process for growing quartz consists of placing small pieces of melting-grade quartz in the bottom of a long, narrow cylindrical vessel capable of withstanding high pressures. Thin sections of perfectly formed quartz crystals are suspended in the upper or growing section of the vessel. The vessel is then partially filled with a solution of sodium hydroxide and sealed. Heat is applied to the vessel, and by careful control, a calculated temperature differential is maintained between the bottom and top or growing zone. The melting-grade quartz is dissolved in the bottom of the vessel and transported by convection currents to the growing zone. There, the quartz is crystallized out on the seed plates because the saturated solution, when cooled to lower temperature, releases some of the dissolved silica.



Simplified schematic drawing of pressure assembly vessel.

Not long ago, Western Electric built a pilot plant to explore the feasibility of growing quartz artificially on a production basis, employing the basic parameters of the laboratory process.

Our engineers started by designing a high pressure autoclave weighing some two tons (see diagram). Where the laboratory model had used a cover which was welded in place to achieve satisfactory sealing, Western Electric engineers developed a screw type metal-to-metal seal which can withstand up to 30,000 pounds pressure per square inch at 800°F without leaking. This combination of high temperature, pressure and corrosive solution is believed to be one of the most severe conditions encountered in any industrial process.



Grown quartz crystals.

Other design problems which had to be solved included: methods of heating, an adequate control system and proper insulation, together with safety procedures which would preclude any hazardous working conditions. From the outset, Western Electric engineers have worked very closely with Bell Telephone Laboratories chemists to perfect optimum crystal growth conditions. At the present time large, perfectly formed quartz crystals can be grown on a repetitive basis. Compared with natural quartz, these man-made crystals have fewer cracks and impurities . . . and because of their uniform dimensions they appear to be ideally suited to modern production methods.

Though refinements are constantly being made, it is expected that growing quartz by this process will ultimately be placed on a production basis.

Here again is demonstrated the creative engineering which goes on at Western Electric in concert with our Bell Laboratories associates. One result is constantly improving, low-cost Bell telephone service.

Western Electric
MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

services substantially.

The company supplied the U. S. Armed Services in two world wars with signals for fighting ships, air bases, and military installations and has equipped U. S. cities with its powerful Thunderbolt rotating 10 horsepower air raid siren as part of the Federal Civil Defense program. Company engineers recently developed a combination electronic siren, mobile public address system and radio amplifier. The 3-way unit, approved for Federal Civil Defense match funds, enables law enforcement officers to turn on a siren, override the siren with vocal instructions, or amplify their radio messages through the siren's loudspeaker if it should be necessary to move away from the emergency car.

• • •

A millivolt transistorized oscillator that reduces bulk and weight, lowers power demands, and eliminates a source of error has been developed by the Hoover Electronics Company, Timonium, Md.

The new oscillator makes it possible to feed the output of low level transducers—such as thermocouples, strain gauges and accelerometers, into the Hoover subcarrier oscillator without DC amplification according to A. J. W. Novak, Vice President and General Manager of the Company.

Eliminating the separate DC amplifier means fewer packages, resulting in a reduction of bulk and weight, lower power consumption and elimination of one possible source of error.

Other attributes of the oscillator include DC common mode rejection and floating input terminals. The DC common mode rejection is rated at 10^7 within ± 20 volts of ground. This permits the oscillator to be used with bridge circuits for measuring the voltage between two points in the bridge, without the oscillator's being affected by a voltage from one point to ground.

The floating input terminals eliminate problems which often result from common ground among several components, the company reports.

• • •

The National Science Foundation is inviting proposals for the construction of better laboratory equipment for U. S. schools from scientists and science teachers in colleges, universities and nonprofit organizations. Meritorious proposals will be supported by the Foundation under a program to encourage the development of inexpensive and practical tools for use in the laboratory phases of science instruction. Under the program, the Foundation will consider proposals for the design and construction of prototypes of improved laboratory equipment and for the development of new instructional materials for lecture demonstrations, laboratory and field work for courses at secondary school and undergraduate college levels in mathematics, astronomy, earth sciences, physical and biological sciences and engineering.

Support under this program will not be provided for the purchase of equipment for refurbishing school and college laboratories, or for commercial production of equipment or materials.

Suggestions for preparing proposals may be obtained from the Course Content Improvement Section, Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C., and completed proposals are to be submitted to NSF before December 31, 1959. Grants will be announced during March 1960.

• • •

The First U. S. Army MARS Single Side Band Technical Net (See SIGNAL, October page 58 and November page 33) has scheduled five speakers for December.

The schedule includes:

December 2: "Technical Aspects of Satellite Communications," by Lowell Smilen, Research Associate. Microwave Research Institute, Brooklyn Polytechnical Institute.

December 9: "The Trans-Atlantic Submarine Telephone Cable," by Harold West, Plant Design Engineer, Long Lines Dept., American Telephone and Telegraph Company.

December 16: "Determination of Percent Success Expectable in High Frequency Radio Transmissions," by George Krause, Project Engineer, Analysis Engineering Division, U.S. Army Signal Radio Propagation Agency, Ft. Monmouth.

December 23: "FM Forward Scatter Tropospheric Communications Systems," by Joseph Lesmez, Project Engineer, Radio Engineering Laboratories, Inc.

December 30: "Coaxial Cable," by Michael Ferber, Sales Engineer, Times Wire & Cable Company.

The net can be heard each Wednesday evening at 9 PM EDT on 4030 kc upper sideband.

The European Productivity Agency is an inter-governmental body set up within the Organization for European Economic Cooperation. By means of a monthly publication, it seeks to promote the dissemination of the latest technical skills and management techniques, and generally to facilitate an exchange of information.

The publication, *European Technical Digests*, contains independently written reports of selected articles published in about a thousand European journals. Although it covers such topics as glass and chemicals, it deals primarily with all kinds of engineering and equipment, metallurgy and agricultural machinery. Much importance is attached to subjects of general interest as well—such as corrosion, materials handling, packaging, safety and management.

In its fourth year of publication, the *European Technical Digests* now appears in German, Italian, Norwegian, Spanish, Turkish and Japanese translations as well as in English.

Yearly subscriptions are available for $12.00. Requests should be directed to *European Technical Digests*, E.P.A., 3 rue André-Pascal, Paris-16, France.

• • •

The PCS-1A Pulse Power Calibrator, an instrument for measuring the instantaneous power in pulsed radio frequency energy, was demonstrated in Washington, D. C., by its inventor, Carl Whittier of the General Communication Co., Boston. The demonstration and press conference was held at the offices of Jansky & Bailey, Inc. in Georgetown.

The new unit measures peak pulse power by comparing the signal amplitude to that of an internally generated, precisely measured, one milliwatt RF signal by a signal in notch technique as displayed on a cathode ray tube.

The standard generator is adjusted to the 1 mw level by means of a precision bolometer bridge and standard cell potentiometer circuit. The accuracy of the bridge and circuit is such as to permit setting to within ± 0.05 db. The standard generator signal is notched at the same rate as the unknown signal and the unknown signal after being placed in the notch is adjusted by means of a calibrated attenuator, to have the same amplitude as the notch. The final answer is in terms of db above or below 1 mw as indicated on the calibrated attenuator dial.

The cathode ray tube is swept twice for every trigger received. Dur-

ing the first sweep the standard generator is notched. The second sweep is unmodulated and therefore produces the amplitude reference line. Any pulse within the notch, whose top coincides with this line, has an amplitude equal to the notch. This eliminates parallax error, and provides a system with sensitivity sufficient to make visible amplitude changes of 0.02 db.

The PCS-1A covers the frequency range 925 to 1225 mc. The power measuring accuracy is within 0.5 db and the relative accuracy when measuring attenuation is within 0.1 db.

The set sells for just under $10,000 and currently is being used by the Navy and 3 commercial companies and is under purchase consideration by the Air Force. One of the instrument's greatest values will be in the field of standardization in this frequency range.

• • •

The U. S. Coast Guard's new SC-130B is undergoing flight tests from the Lockheed engineering flight test center.

The prop-jet Hercules, in production at Lockheed's Georgia Division at Marietta, has an antenna in cable form which when fully unreeled stretches 225 feet from the underside of the pilot's cockpit.

The cable is the nerve center for a master communication system which ties in all surface vessels and aircraft while a search and rescue is being undertaken. This enables a crew member to coordinate all activity during an emergency at sea.

Initial test flights of the plane were described as successful. The first search and rescue Hercules is due for delivery to the Coast Guard this month.

The SC-130B is powered by four Allison T56-A-7A prop-jet engines, giving it the capability of flying high and fast—or low and slow. It has a maximum take-off and landing weight of 135,000 pounds and a cruise speed of 370 mph. With full fuel capacity and a payload of 20,000 pounds, it has a range of 3,500 miles.

• • •

Potter and Brumfield, relay manufacturers, have published the complete papers of the Seventh Annual Conference on Electromagnetic Relays held at Oklahoma State University, Stillwater, Oklahoma.

The Conference, held under the combined auspices of the National Association of Relay Manufacturers and Oklahoma State University, was attended by representatives from the United States, Belgium, England, France and Japan.

Copies of the booklet may be obtained from the Advertising Department, Potter and Brumfield Division of American Machine and Foundry Co., Princeton, Indiana.

Photoprogress

Doctors David Simonsen, Charles Vilbrandt and Guy Stone presented a paper on a rolling ball viscometer before the annual meeting of the American Chemical Society in Atlantic City, N. J.

The new automatic instrument is being used by Eastman Kodak Company in measuring the viscosity of photographic emulsions at Kodak Park Works in Rochester, N. Y.

The viscometer consists of a precision glass tube, mounted in an inclined position in a temperature-controlled water bath, the scientists said. The tube is filled with the liquid to be measured and a steel ball, with a variation in size of less than 6/100,000 of an inch, is dropped into it.

The time taken by the ball to travel the distance between two magnetic coils that surround the tube near the top and bottom is a measure of the viscosity of the liquid, they explained.

Since the ball is steel, changes it causes in each of the magnetic fields start an electronic clock when the ball passes through one field and stop it when it enters the other. The time of passage is therefore measured very accurately.

The Kodak researchers said the viscometer is easy to operate and has given accurate, reproducible results at Kodak Park. The company has no present plans to manufacture or sell the instrument.

• • •

Some of the latest developments in motion picture and television engineering were shown at the 86th semi-annual convention of the Society of Motion Picture and Television Engineers, held in New York City last month.

A showing of the military uses of motion pictures and television by the United States Army, Navy and Air Force during the equipment exhibit dramatized the theme of the convention, "Motion Pictures and Television in the Space Age."

The U. S. Army Signal Corps showed panels depicting military uses of combat photography and the prototype of a tactical television system.

The U. S. Naval Training Device Center displayed trainers for inner space designed to train operators and maintenance men for the exacting operations in nuclear submarines operating in the ocean's depths.

The U. S. Air Force exhibited 10 scale models of the Thor-Able Moon Rocket, Atlas ICBM and Titan ICBM. Recorded narration described missile capabilities and ended with countdown and simulated blast-off. The exhibit was prepared by the U. S. Air Force Orientation Group, Wright-Patterson Air Force Base, Ohio.

• • •

A dictionary of camera repair terms containing over 2500 entries has been published by the National Camera Repair School.

Included are words and phrases applying to the mechanics of photography that show the inter-relation between photographic equipment and many other fields of technology. The glossary includes electronics terms, metal working terms, engineering terms and others related to this growing field.

The book is also aimed at standardization of words describing the intricate mechanisms found in cameras and other photo equipment.

Copies of *The ABC's of Camera Repair* are available at $3.95 a copy from National Camera Repair School, Box 174HI, Englewood, Colorado.

• • •

Designed to produce flashes of light at rates up to 6000 cps, with a minimum flash duration of 1.2 microseconds, the Type 501 Stroboscope can be synchronized with either streak-type or rotating prism type high speed cameras. This high speed performance is of value for the quantitative study of fast-moving phenomena such as shock waves and the flight of projectiles. The stroboscope light stops the motion of rapidly moving subjects and permits accurate measurements of form, velocity and acceleration.

The 501 Stroboscope gives many times better definition than incandescent light according to Edgerton, Germeshausen and Grier, Inc. of Boston who developed the instrument. This is of particular advantage where frame-by-frame inspection of the film is to be made for purposes of analysis by measurement. The relative coolness of stroboscope light is a further advantage in those cases where the subject is liable to damage by heat.

Sufficient light output is obtained

for schlieren photography of flames, jets, and explosions when the unit is used with a suitable optical system.

• • •

Infrared and Ultraviolet Photography, a revised publication carrying the latest information on Kodak films and how to use them for best results in this specialized field, has been issued by Eastman Kodak Company.

Kodak's infrared film, 135 film, and high-speed film and their applications are discussed in detail. Proper exposure recommendations, to compensate for recent film advances are given.

More than 60 sources of technical information have been added to the bibliography.

Copies of the publication are available at $.50 a copy from Kodak dealers.

• • •

The Audio-Master Corporation of New York is producing a low priced sound filmstrip projector combination suitable for industry, schools and institutions.

The Audioscope Executive is a 15 pound portable unit and accommodates 12-inch records giving 25 minutes of uninterrupted narration or 50 minutes from both sides of the record. The phonograph has a 4-speed motor for playing 16, 33, 45 and 78 r.p.m. records, a 3-tube high gain amplifier and a 5 inch loudspeaker. It operates on AC, 110 volts with approximately 3 wattage peak. The projector has a precision optical system with coated, color-corrected anastigmat f3.5 lens, 75 watt projection lamp, 6" x 8" viewing on patented process "lenscreen" with wide-angle viewing area, front surface mirror system, simplified one-knob film advance and framing device with clickstops, filmstrip feed and take-up attachment, and rapid positive picture control assured with simple, precision helical focusing device.

• • •

An illustrated, four-page folder is available from Traid Corporation, Encino, Calif., describing over 57 different lenses available to motion picture camera users in any field.

The folder covers a wide range of wide-angle, normal, long focal length and zoom lenses for 16 mm and 35 mm cameras and includes information on lenses for 70 mm and prism cameras as well.

The *Lens Selector* is available without charge upon request to Traid Corporation, 17136 Ventura Boulevard, Encino, Calif.

Names in the News

Edward J. O'Neill was re-elected chairman of the Armed Forces Small Business Council, Penn-Del Chapter at the group's September meeting in Philadelphia. Mr. O'Neill is Chief of the Small Business and Industry Liaison Office at the Signal Supply Agency.

Clinton Kaplan has been appointed Director, Industry Relations, U. S. Army Signal Supply Agency, according to Brigadier General Elmer L. Littell, Commanding General of the agency. Mr. Kaplan will conduct studies and establish programs designed to foster and strengthen understanding and cooperation in the Army-Industry team.

Colonel Carl H. Hatch, who planned and set up the organization for the future incorporation of Alaska's tele-communications system as a self-sustaining industry of the 49th state, retired September 30 from his post as Commanding Officer of the U. S. Army Alaska Communication System.

George A. Strichman, formerly director of manufacturing services for the Raytheon Company, has been appointed president of Kellogg Switchboard and Supply Company, Chicago, Ill., communications division of International Telephone and Telegraph Corporation. **Hugh J. Tremblay** has been appointed manager of military systems sales at the company. Mr. Tremblay will be responsible for sales of military communications systems, both directly to the government or through common carriers or weapon system contractors.

Clinton E. Roche was recently named sales manager of the General Communication Company of Boston. Mr. Roche was formerly field sales manager for the company.

Henry Lehne has assumed his duties as senior vice president of Sylvania Electric Products Inc., a subsidiary of General Telephone & Electronics Corporation. Mr. Lehne has over-all responsibility for Sylvania Electronic Systems, a division engaged in research, development and manufacturing activities in advanced electronic fields.

Dr. Robert E. Beam, professor of electrical engineering at Northwestern University, has been named vice president in charge of research and development for the Hallicrafters Company of Chicago.

John L. Heins, former chief electronics engineer for the Republic Aviation Corporation, Missile Systems Division, has been named head of engineering for the GB Electronics Division of the General Bronze Corporation, Long Island, New York.

Creation of two new posts within the Defense Electronic Products organization of RCA, was announced by Arthur L. Malcarney, executive vice president. **Walter G. Bain** was appointed vice president and general manager, Communications and Missile Electronics and **Harry R. Wege** was named vice president and general manager, Missile and Surface Radar. **Richard E. Posthauer** will succeed Mr. Bain as manager of Defense Electronic Product's Washington office.

John J. Burke, recently elected a vice president of The Siegler Corporation, Los Angeles, will direct a new program designed to integrate all the corporation's defense activities. Mr. Burke was formerly executive vice president of the Hallamore Electronics division of Siegler.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, etc., required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946, of SIGNAL Magazine, published monthly at Washington, D. C. (additional entry, Baltimore) for October 1958.

District of Columbia }
City of Washington } ss.

Before me, a notary public, in and for the State and County aforesaid, personally appeared W. J. Baird, who, having been duly sworn according to law, deposes and says that he is the Editor of the SIGNAL Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership and management of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946, to wit:

1. That the names and addresses of the publisher, editor, managing editor are:

Publisher: Armed Forces Communications and Electronics Association, 1624 Eye St., N. W., Washington 6, D. C.

Editor: W. J. Baird, same address.

Managing Editor: Judith H. Shreve, same address.

2. That the owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Armed Forces Communications and Electronics Association, 1624 Eye Street, N. W., Washington 6, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

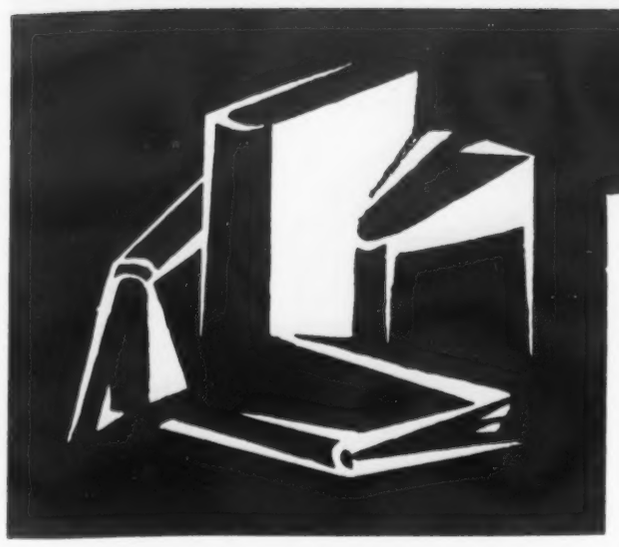
4. That paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also that the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees hold stock and securities in a capacity other than that of a bona fide owner.

W. J. BAIRD,
Editor.

Sworn to and subscribed before me this 25th day of September, 1959.

(Seal) MARY E. CROWE
Notary Public.

(My commission expires November 30, 1962.)



Books

THE NEUTRON STORY, by Donald J. Hughes. Anchor Books, Doubleday & Co., Inc., N. Y., 1959. 158 pages, $0.95.

In 1940, twenty-five year old Donald J. Hughes received his Ph.D. degree in the field of cosmic rays from the University of Chicago. A bare three years later he was working on the Manhattan Project with other gifted scientists helping to usher in the nuclear age.

At present Dr. Hughes is a senior physicist at the Brookhaven National Laboratory, Upton, Long Island, where he directs a group doing pile neutron research. *The Neutron Story* is his sixth book. The Russians, who translated three of the others, found one book so impressive that they ordered a first printing of 20,000 copies. By American standards this is an incredible number for a highly technical work.

Just thirty years ago the neutron, its importance based on its lack of an electrical charge, was an unknown particle. Today, a whole field of research, neutron physics, is based on its properties. Dr. Hughes presents the neutron's short history which began in 1932, its properties, applications and accomplishments. The book is directed to the general reader interested in the meaning of modern science as well as to the science student.

The neutron can indeed name many practical applications among its accomplishments. It became the means for demonstrating the fission of uranium, the process that showed that large amounts of matter might actually be destroyed thereby releasing energy. In 1942, the neutron participated in the successful release of energy from mass on a practical scale in the controlled chain reaction and in 1945, the chain reaction was adapted to produce an atomic bomb.

It has found peacetime employment in the production of electrical power and radioisotopes for medical and industrial uses.

Dr. Hughes considers the neutron primarily in its function in pure research for it is by means of basic research that discovery and understanding of laws fundamental to all matter and its manifestations occur.

THE VALIANT STRAIN, by Kenneth E. Shiflet. Dell Publishing Co., Inc., N. Y., 1959. 224 pages, $0.35.

The Valiant Strain is a novel concerning a lone Dragoon Company striving to maintain civilization in the Oregon territory of 1855. It is also the story of Lieutenant Edward S. Graham, a green lieutenant who is assigned the difficult task of replacing the well-liked Commanding Officer of the F Company Dragoons.

The dragoons were the Army troops who fought with single-shot breech-loading flintlocks against the hostile Indian tribes of the Northwest. They were a proud company, proud of their courage in battle and proud of the officer who led them. The feelings of the men of F Company approached deific proportions in regard to the Captain who had ignored instructions from his regiment and led his outnumbered company into the Cascades to fight off an Indian attack on a blockhouse. As a result of the venture the Captain and many of his men lost their lives.

The Captain's replacement. Lieut. Graham, is a well-polished young officer from the East. He quickly arouses the contempt of his men, most of whom are experienced Indian fighters and far removed from the days of sword polishing and parade drill. The Lieutenant launches his career with the dragoons by imposing and enforcing strict Army regulations, drill and discipline on men who have fought long, hard and courageously in combat. Although he is labeled cowardly by his men when he avoids skirmishes with marauding Indians in order to fulfill commands, in time Graham earns their respect.

The author, Ken Shiflet, is an ardent AFCEA supporter and member.

THE UNITED STATES MARINES, A Pictorial History, by Lynn Montross. Rinehart & Co., Inc., N. Y., 1959. 242 pages, $10.00.

Text, drawings, photographs and paintings trace the growth of the Marine Corps from the rough-and-ready Corps of early days to a modern fighting force. This is an exciting review of those historic highlights which illuminate the place of the Marines in the hearts of the American people, and the most complete history of the Corps in print.

Since 1775, the "soldiers of the sea" have fought as often in jungle or mountain terrain as on swaying decks. They were among the pioneers in combat aviation and they have specialized in a tactical element of their own—the shot-swept beaches, representing the transition from ship to shore in an amphibious landing

More than two-hundred amphibious landings have been made during eight generations of Marine Corps history.

BEYOND SURVIVAL, by Max Ways. Harper & Brothers, New York, 1959. 250 pages, $4.00.

Max Ways, while chief of the *Time-Life* London Bureau, was asked to undertake a review of United States foreign and military policy in the postwar period by Henry R. Luce, editor-in-chief of Time Inc. publications. The object was to appraise the present United States position in a way that might sharpen the perspectives of future news reporting.

Mr. Ways found that review as such would be of little use because public standards of judgment in this area were not sufficiently defined.

Beyond Survival examines some formulations of our purpose, such as "survival" and "national interest." The author finds them inadequate as a basis for making and judging policy. The inability to form a sense of political purpose he attributes to a defective link between our society's fundamental beliefs and its politics. He believes the trouble is in the public mind, inhibited by modern patterns of thought from political judgments based on principles of intellectual and moral order. He says: "Our military technologists are not to blame. Theirs has been the task of planning for a nation that does not understand clearly what it wants to do and is in moral confusion about the means it may use to do it." He believes, "our right purpose should be to protect and extend institutions of order and freedom in the world. We have a treasure house of experience in the relation between order, freedom and technology—but this experience will not be available for politics unless our society can still deal vigorously with political philosophy at the level of the Declaration and the Constitution."

Chapter News

(*Continued from page* 51)

Group. Fort Sam Houston Officers' Club was the scene, with some 40 members and guests present.

Mr. Coppock stated that the Trendex Research Group was the first economic research organization to use electronic computer equipment for long-range stock market forecasting.

Personnel Available

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ——, SIGNAL, 1624 Eye St., N.W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

FIELD REPRESENTATIVE with thorough knowledge of government procurement practices with respect to R&D and production contracts in communications and electronics. Presently employed in eastern area, desires to relocate in Florida. Box 150.

TRIAL ATTORNEY before Armed Services Board of Contract Appeals desires legal or executive position with national corporation engaged in defense work. Former Legal Advisor, Signal Corp Midwestern Regional Office. Box 151.

WASHINGTON REPRESENTATIVE with several years experience handling both field and contractural problems. Familiar with research and development and production work in the communications-electronics field. Four years at present company. Box 152.

LIAISON REPRESENTATIVE FIRM desires to assist companies with Government business by acting as their Washington representative. Box 153.

National Advertising Representatives

William C. Copp & Associates

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New AFCEA Members

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Rome-Utica

Lt. (j.g.) Sherwood V. Sarle
Leopold Sternlight
Fred P. Pro
Douglas J. Hughes

San Francisco

H. P. Blanchard

San Juan

Lt. Cdr. Rudolph E. Trip
Jose Mendez
Lt. Jimmie D. Woods
Rafael G. Roman
Eugene W. Turner

Santa Barbara

Clement W. Ausman

Scott-St. Louis

Maj. Harold W. Christy
Col. David M. Crabtree, Jr.
Lt. Col. Tom S. Clark
Arvin D. Gilliland
Lt. Col. Robert L. De Bord

Seattle

Russell E. Winslow

South Carolina

N. Jean Hodges
Luther R. Gower
James E. Bouknight
Marion W. Trotti

Southern California

Cameron G. Pierce
Alvis A. Ward
Robert F. Martin
Charles Theodore
James A. Ross
Paul S. Goodwin
Allyn B. Ostroski
John K. Hilliard
William C. Speer
Lt. (j.g.) John J. Corcoran
R. C. Tetherow
Harold D. Germann
Gene H. White
Milton W. Heyne

Tinker-Oklahoma City

Maj. Ivan S. Miller
1st Lt. Percival Anderson
Muril W. Donnell
Albert P. Gilbert

Washington

Harold E. Wilcox
Maj. Gen. Roger B. Colton
Lester H. Carr
Vincent B. Terminello
Cdr. Harvey O. Vogel
Vernon D. Hawkins
Arthur Fleischer
Bruce G. Oldfield
Col. Mallory J. Read
Donald G. Boegehold
Charles O. Wallace

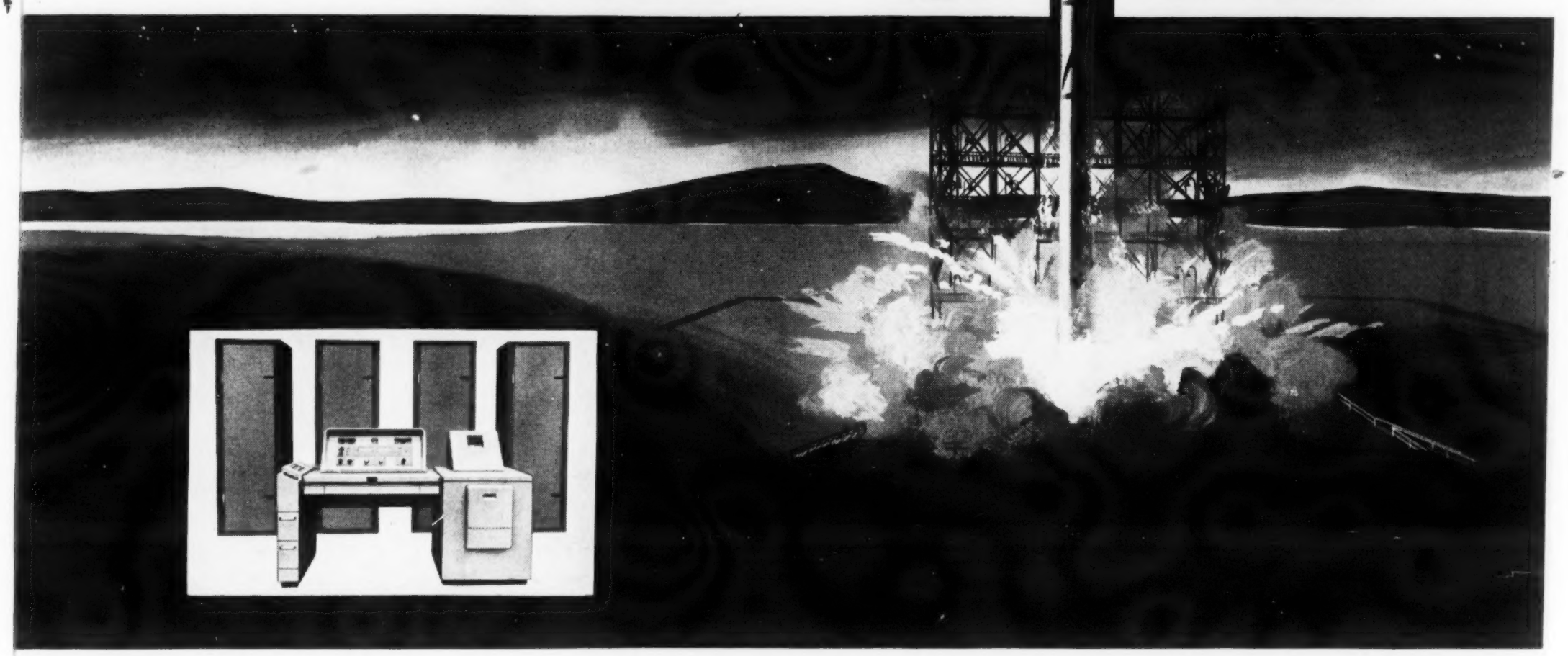
Members At Large

John F. Dugan, Albany, N. Y.
E. C. Slaughenhaupt, Cleveland, Ohio
Kenneth T. Thomas, West Hartford, Conn.
William F. Miller, Mishawaka, Indiana
Capt. Charles H. McLaughlin, Dugway, Utah
Orville C. Kuberski, El Paso, Texas
Ensign Robert B. Heiple, USS Valley Forge, FPO, N. Y., N. Y.
James E. Corbett, Tallahassee, Florida

APCHE

(Pronounced "AP-SHE")

The Checkout that says "GO" or "NO GO"



APCHE (Automatic Programmed Checkout Equipment) is a solid-state, universal, high-speed, highly reliable, compact general-purpose tester designed especially for automatic checkout of aircraft, missile and space systems and their supporting systems. In its various versions (differing in input media, size and weight) APCHE installations may be fixed, mobile, airborne or submarineborne. APCHE was designed and is being produced as a part of RCA's ground support electronics subcontract from the Convair (Astronautics) Division of General Dynamics Corporation, prime contractor for the ATLAS Intercontinental Ballistic Missile.

The system being supplied to Convair for the ATLAS Program includes a console and four rack cabinets providing both analog and discrete test functions with a resulting printed and GO-NO GO indication. As a product of RCA's Missile Electronics and Controls Department, Burlington, Massachusetts, APCHE is one of the latest RCA developments in the field of military weapon readiness equipments.

RADIO CORPORATION of AMERICA

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Tmk(s) ®

SHAGGY FISH STORY

At the height of the Boston Tea Party, while the "Indians" were busy throwing everything in sight over the side, the British radar operator suddenly found himself pitched overboard.

Since he couldn't swim, he clung precariously to a wooden tea case bobbing in the water, and floated aimlessly around, thrashing wildly and yelling for help.

Just as he was about to lose his grip on his precious raft, a codfish surfaced nearby.

"What's going on here?" the codfish asked.

"Some wild Indians surprised our radar, overran the ship, and threw all the tea overboard," the radar man gasped.

"Well," the codfish said, "Bet you a fin you didn't have any Bomac tubes in that radar of yours."*

"Good cod, here I am drowning in front of your eyes and you have to give me a commercial," the man said. "I can't hang on much longer!"

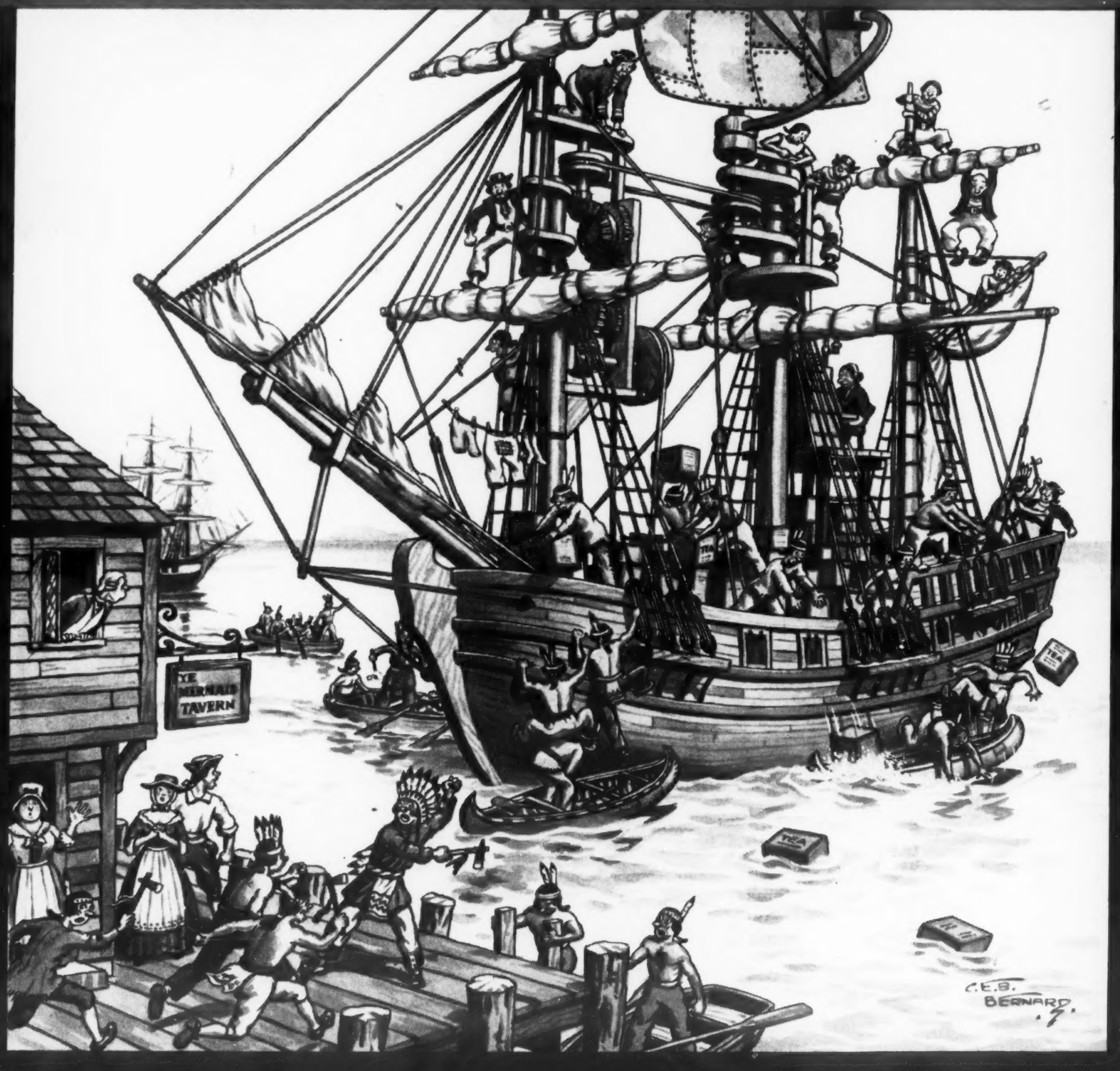
The fish ignored him. " . . . Anybody knows Bomac makes the finest microwave tubes and components either side of Boston Harbor," he said.

"Look," the man said. "I've just about haddock. But tell me this: How do you know so much about microwaves?"

"I'm no expert," the codfish said. "I just dabble in it for the halibut."

"O," the man said. And he sank silently into the sea.

No. 16 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES



* *Bomac makes the finest microwave tubes and components either side of Boston Harbor*

BOMAC

Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; crystal protectors; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

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